SOIL SURVEY

Johnson County Tennessee

Series 1946, No. 2

Issued August 1956

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with the
TENNESSEE AGRICULTURAL EXPERIMENT STATION
and the
TENNESSEE VALLEY AUTHORITY

How to Use THE SOIL SURVEY REPORT

FARMERS who have worked with their soils for a long time know about differences among soils on their own farm, and perhaps about differences among soils on the farms of their immediate neighbors. What they do not know, unless soil surveys have been made, is how nearly their soils are like those on experiment stations or on other farms, either in their State or other States, where farmers have gained experience with new or different farming practices or farm enterprises. Farmers of Johnson County can avoid some of the risk and uncertainty involved in trying new crop and soil management practices by using this report, for it maps and describes the soils of their county and therefore allows them to compare soils on their farms with soils on which new developments have proved successful.

SOILS OF A PARTICULAR FARM

All the soils in Johnson County are shown on the soil map accompanying this report. To learn what soils are on any farm, it is first necessary to locate this farm on the map. This is easily done by using landmarks such as roads, streams, villages, dwellings, and other features to locate the boundaries.

The next step is to identify the soils. Suppose, for example, you find on your farm an area marked with symbol HB. Look among the colored rectangles in the margin of the soil map and find the one with HB printed on it; this symbol means Hagerstown silty clay loam, eroded rolling phase. All areas of this soil, wherever they occur on the map, are identified by the color and symbol shown in this rectangle.

What is Hagerstown silty clay loam, eroded rolling phase, like, and to what use is it suited? This information will be found in the section on Soil Descriptions and can be quickly located by using the table of contents.

How much does Hagerstown silty clay loam, eroded rolling phase, produce under the management it now receives, and how much will it produce if management is improved? First read the introductory part of the section, Use and Management of Soils, which explains the fundamentals of good management and how the soils of this county have been placed in management groups, all the soils needing about the same management in one group. Then turn to management group 3, which is made up of Hagerstown silty clay loam, eroded rolling phase, and other soils that require about the same management. Read about the present management of these soils and the management practices suggested for them. Then turn to table 8 and read in columns A the crop yields expected under present management, and in columns B the yields expected under suggested management.

SOILS OF THE COUNTY AS A WHOLE

A general idea of the soils of the county is given in the introductory part of the section, Soils of Johnson County, Their Use and Management, and in the section, Soil Associations. These sections tell about the principal kinds of soils, where they are found, and how they are related to one another. After reading these sections, study the small soil association map in the margin of the large soil map and notice how the different kinds of soils tend to be arranged in different parts of the county. These patterns are often associated with well-recognized differences in type of farming, land use, and land-use problems.

A newcomer to the county, especially if he considers purchasing a farm, will want to know about the climate; land use; the principal farm products and how they are marketed; the kinds and conditions of farm tenure, including tenancy; availability of roads, railroads, electric services, and water supplies; the industries of the county; and cities, villages, and population characteristics. Information about all these will be found in the sections General Nature of the Area and Agriculture.

Those interested in how the soils of the county were formed and how they are related to the great soil groups of the world should read the section, Morphology and Genesis of Soils.

This publication on the soil survey of Johnson County, Tenn., is a cooperative contribution from the—

SOIL CONSERVATION SERVICE
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TENNESSEE AGRICULTURAL EXPERIMENT STATION
and the
TENNESSEE VALLEY AUTHORITY

Series 1946, No. 2 Issued August 1956

SOIL SURVEY OF JOHNSON COUNTY, TENNESSEE[1]

By RALPH G. LEIGHTY, In charge,[2] Soil Survey,[3] United States Department of Agriculture, and F. R. AUSTIN, CLIFTON JENKINS, and FOSTER RUDOLPH, Tennessee Agricultural Experiment Station

Area inspected by J. W. MOON, Soil Scientist, Soil Survey

United States Department of Agriculture, in cooperation with the Tennessee Agricultural Experiment Station and the Tennessee Valley Authority

CONTENTS

[1] The report was prepared by L. E. Odom, Soil Survey, United States Department of Agriculture.

[2] Clifton Jenkins and Foster Rudolph were in charge for part of the time.

[3] Work on this report was done when Soil Survey was part of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Soil Survey was transferred to the Soil Conservation Service on November 15, 1952.

JOHNSON COUNTY, in northeastern Tennessee, consists of two lowland belts between high parallel mountain ridges. It has cool summers and lacks a distinct dry season. The county is agricultural, but forests are among its valuable natural resources. About 73,000 acres is in National forests. The surface soils are predominantly silt loam and loam. Most of the lowlands are underlain by dolomite or dolomitic limestone, but a very large part of the important soils for crops are made up of colluvial or alluvial deposits. A wide variety of crops is grown; the most important are corn, tobacco, snap beans, red clover, and lespedeza. Beef cattle, dairy cattle, and hogs are the most important livestock, but poultry is raised on most farms. Mountain City, the county seat, is the principal market and shipping point for farm products. Johnson City, Elizabethton, and Bristol in adjoining or nearby counties are also important market and trading centers. To provide a basis for the best agricultural uses of the land, this cooperative soil survey was made by the United States Department of Agriculture, the Tennessee Agricultural Experiment Station, and the Tennessee Valley Authority. Field work was completed in 1946, and unless otherwise specifically mentioned, all statements in this report refer to conditions in the county at that time.

GENERAL NATURE OF THE AREA

Johnson County is in the extreme northeastern corner of Tennessee (fig. 1). Mountain City, the county seat, is 125 miles northeast of Knoxville; 280 miles northeast of Nashville, the State Capital; and 470 miles northeast of Memphis. The land area of the county is approximately 299 square miles, or 191,360 acres.

The first settlements in what is now Johnson County were made about 1770 in the vicinity of Butler. The settlement of the area progressed rather slowly. The county was formed in 1836 from a part of Carter County, and Taylorville was the county seat. In 1885 the name of this town was changed to Mountain City (*2*).[4]

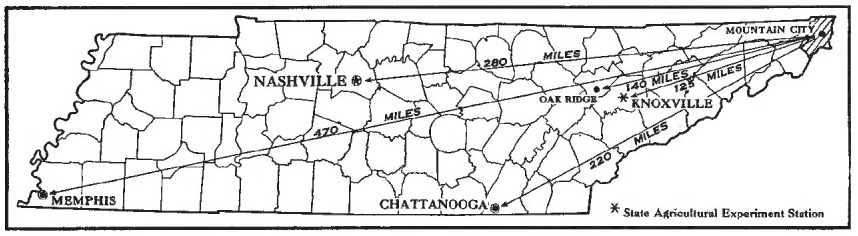

FIGURE 1.—Location of Johnson County in Tennessee.

The early settlers were mainly from North Carolina, but some were from Virginia and South Carolina. They were largely of English descent, but included some of Scotch or Irish descent. The present population consists largely of decendants of these early settlers. The county had a population of 12,278 in 1950, all of which was rural. Mountain City, the principal town, had a population of 1,405 in 1950.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

Johnson County is within the Unaka Range of the Blue Ridge province, although the central part might be considered a part of the Ridge and Valley province (*1*). The county consists of two comparatively narrow lowland belts between high parallel mountain ridges.

The main lowland belt, which includes the valleys of Roan, Doe, and Laurel Creeks, extends southwestward from the Virginia-Tennessee State line and forks around Doe and Dry Run Mountains (fig. 2). It varies from 1 to 4 miles in width and covers approximately one-fourth of the county. The elevation ranges from about 1,800 feet to approximately 3,200 feet, averaging about 2,500 feet. Stone and Forge Mountains are on the southeast and east, and the Iron Mountains are on the northwest.

Shady Valley, a covelike valley in the northwestern part of the county, is almost completely surrounded by Iron, Cross, and Holston Mountains. It is about 2½ miles wide and 7 miles long, and like the other lowland belt, lies in a northeast-southwest direction. The average elevation is about 2,900 feet. Sutherland valley, which is

[4] Italics numbers in parentheses refer to Literature Cited, p. 150.

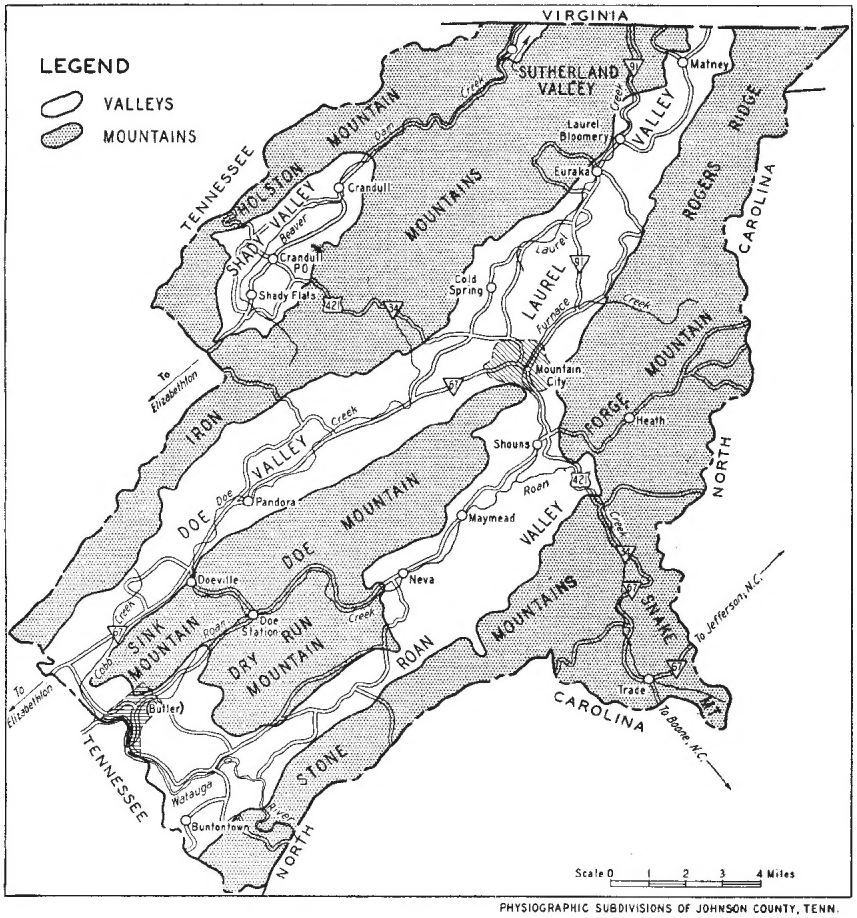

FIGURE 2.—Physiographic subdivisions of Johnson County, Tenn.

about three-fourths of a mile wide and over a mile long, is northeast of Shady Valley along the Virginia-Tennessee State line.

The lowland belts consist of narrow valleys and interposing knobs and ridges. Several prominent ridges are 100 to 400 feet above the flood plains of the major streams. Some ridges are comparatively long and have sharp, winding crests; others are dome-shaped or cone-topped. The slopes are nearly everywhere short and steep.

In general the areas of steeper relief are near the mountains; the smoother areas are mainly on the drainage divides and colluvial foot slopes near the main streams. A small acreage of level or gently undulating land is on the low terraces and first bottoms along the major streams. The low terraces and first bottoms vary in width from a few feet to a maximum of nearly one-half mile. Limestone sinks are numerous in Taylor valley, in the valley of Laurel Creek, and in the vicinity of Butler (now inundated). These limestone areas have a karstlike topography. Dolomite or dolomitic limestone and shale

underlie most of the lowlands, but a very large part is covered with colluvial or alluvial deposits (*4*).

Practically all of the rest of the county is mountainous. The highly dissected mountains in the eastern part are characterized by great extremes in elevation. Elevations range from about 2,400 to 5,500 feet. Slopes are very steep, and mountain crests or ridgetops, as well as the intervening valleys, are narrow. Quartzite and conglomerate underlie most of these mountains, but an old highly dissected plain in the southeastern part is underlain by granitic rocks (*4*). Snake Mountain, in the extreme southeastern corner of the county, is 5,518 feet above sea level. Forge and Stone Mountains, which form the eastern and southeastern boundaries of the county, range in elevation from about 3,800 to 4,980 feet.

Holston, Cross, and Iron Mountains, in the northwest part of the county, range from about 3,500 to 4,175 feet in elevation. Doe, Sink, Dry Run, and Little Dry Run Mountains, which are entirely within the county, range from about 2,400 to 3,800 feet in elevation and have sharp, narrow, fairly straight ridge crests with some low peaks and knobs. The slopes are steep and in many places rugged and broken. The intermountain valleys are very narrow to moderately wide. These mountains are underlain chiefly with quartzite and conglomerate (*4*).

Johnson County is drained by the Watauga and the South Fork Holston River systems. The southern two-thirds of the county is drained by Roan, Doe, and Cobb Creeks, which empty into the Watauga River near Butler (now inundated). Beaverdam and Laurel Creeks flow northeastward from the divide and enter the South Fork Holston River a few miles north of the Virginia-Tennessee State line. All of these creeks flow approximately parallel to the main valleys, but their tributaries flow transversely through the intervening ridges and knobs from all parts of the county. Drainage is good except in a few low, flat areas near some of the streams.

CLIMATE

Johnson County has a humid, temperate climate.[5] Its salient features are the cool summers and the lack of a distinct dry season. Precipitation is well distributed throughout the year. The spread between the average summer and winter temperature is not great.

Owing to the great differences in elevation within the county, there is considerable variation in climate. Temperature and precipitation data compiled from United States Weather Bureau records are given in table 1. The data from the Weather Bureau station at Mountain City is representative of climatic conditions in the valleys, and that from the station at Banner Elk in Avery County, N. C., is thought to be representative of conditions in the mountain areas, although the climate in much of the county is probably intermediate between the two. As shown by this table, in the representative mountain area the annual precipitation, which includes 17 inches more snow, averages about 10 inches more and the annual temperature about 3° F. less than in the valley area. There are other important differences, such as more fog and clouds and a shorter frost-free period in the mountains.

[5] This classification of climate is after W. Koppen (*7*).

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Mountain City, Johnson County, Tenn., and Banner Elk, Avery County, N. C.*

MOUNTAIN CITY, JOHNSON COUNTY,[1] ELEVATION 2,500 FEET

Month	Temperature			Precipitation			
	Average	Absolute maximum	Absolute minimum	Average	Total for the driest year	Total for the wettest year	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	35.2	72	−32	3.45	2.14	8.36	4.6
January	36.1	75	−11	3.71	1.69	4.10	6.5
February	35.3	71	−16	3.38	.97	1.61	4.6
Winter	35.5	75	−32	10.54	4.80	14.07	15.7
March	45.1	82	−8	4.39	3.76	4.18	3.1
April	51.1	88	15	3.43	2.29	6.51	1.0
May	61.3	94	25	4.06	1.47	8.17	(2)
Spring	52.5	94	−8	11.88	7.52	18.86	4.1
June	67.6	91	36	4.53	3.15	8.14	.0
July	70.2	95	40	5.89	8.66	4.45	.0
August	69.2	95	38	4.86	3.68	16.54	.0
Summer	69.0	95	36	15.28	15.49	29.13	.0
September	63.7	88	29	3.05	1.35	2.02	.0
October	53.6	87	14	2.62	.96	3.30	.2
November	42.6	78	−5	2.14	2.08	.89	1.6
Fall	53.3	88	−5	7.81	4.39	6.21	1.8
Year	52.6	95	−32	45.51	[3] 32.20	[4] 68.27	21.6

[1] Average and maximum and minimum temperatures based on a 24-year record, 1907 to 1930; average precipitation and wettest and driest years based on a discontinuous year record, 1897 through 1951; and snowfall on a 25-year record, 1906 to 1930.

[2] Trace.

[3] In 1941.

[4] In 1901.

Local variations in temperature and precipitation due to lay of the land, effect of relief on air drainage, differences in elevation, and proximity and relation to mountains are apparent, although no data on amount of variation are available. Vegetation in the valleys and depressions is frequently killed by frosts, whereas that on the ridges shows no injury. Early fall and late spring frosts are invariably more injurious at the lower elevations. Frost injury of fruit trees is less frequent on ridgetops and north-facing slopes than on south-facing slopes, because growth in spring is more retarded. Winter-killing of perennials, small grains, and other winter crops, owing to freezing and heaving, is more frequent on slopes characterized by seepage.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Mountain City, Johnson County, Tenn., and Banner Elk, Avery County, N. C.*—Continued

BANNER ELK, AVERY COUNTY,[5] ELEVATION 3,710 FEET—Continued

Month	Temperature			Precipitation			
	Average	Absolute maximum	Absolute minimum	Average	Total for the driest year	Total for the wettest year	Average snowfall
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	34.5	75	−21	4.59	2.18	5.54	7.4
January	34.4	67	−13	3.72	3.37	8.65	8.6
February	34.4	72	−11	3.78	3.11	4.86	9.3
Winter	34.4	75	−21	12.09	8.66	19.05	25.3
March	40.6	82	−7	5.33	2.32	5.11	9.3
April	48.6	86	7	4.24	3.75	6.64	1.0
May	56.3	85	22	4.85	1.41	5.57	(2)
Spring	48.5	86	−7	14.42	7.48	17.32	10.3
June	63.4	88	27	5.37	6.62	5.67	.0
July	66.4	95	35	6.26	2.31	7.60	.0
August	65.7	94	31	5.85	.31	8.24	.0
Summer	65.3	95	27	17.48	9.24	21.51	.0
September	61.4	93	28	4.43	1.51	1.30	.0
October	50.9	82	11	4.91	4.96	12.54	1.0
November	41.0	75	−7	2.60	4.20	1.23	2.4
Fall	51.1	93	−7	11.94	10.67	15.07	3.4
Year	49.8	95	−21	55.93	[6] 36.05	[7] 72.95	39.0

[5] Average temperature based on a 44-year record, 1908 to 1951, and maximum and minimum temperature from a 24-year record, 1907 to 1930. Average precipitation based on a 44-year record, 1908 to 1951; wettest and driest years on a 44-year record, 1908 to 1951; and snowfall on a 24-year record, 1907 to 1930.

[6] In 1925.

[7] In 1908.

The average frost-free season in the valleys is 167 days, extending from April 27 to October 11, which is ample time to grow and mature the important field crops. Perennial and winter annual crops are successfully grown, especially on the well-drained soils. Frosts have occurred as late as May 15 and as early as September 22, but at such unusual dates they are seldom severe. Late frosts in the spring occasionally injure some crops, and early frosts in the fall sometimes damage late-maturing corn, tobacco, and beans. Heaving of small grains and fall-seeded legumes is more prevalent in the mountains than

in the valleys. The average frost-free season at Banner Elk, which is thought to be representative of the mountainous part of the county, is about 148 days.

Rainfall is slightly greater in summer than in fall. Dry periods long enough to injure crops severely are rare, but excessively cloudy and rainy periods do occur rather often, especially in the winter and spring, and are particularly detrimental to the small-grain crops. Rainfall is generally ample for the common crops and is very favorable for the production of high-quality vegetables, particularly snap beans. Hailstorms and tornadoes are to be expected, but not frequently.

WATER SUPPLY

Because of the many springs, creeks, and branches, the supply of water for cattle and other animals is adequate in years of normal rainfall, but there is a shortage in some localities during protracted dry seasons. Good springs supply drinking water on nearly every farm except in the large areas of shaly land. Some farms have cisterns or drilled wells to supplement their water supply.

VEGETATION

Practically all of the county was originally forested with white pine-hardwood, yellow pine-hardwood, oak-chestnut, and upland hardwood forests.[5a] The undergrowth consisted largely of rhododendron, laurel, hazelnut, huckleberry, cranberry, ferns, and numerous herbaceous plants. About 65 percent (*6*) of the county is still in forest, approximately 73,000 acres of which is in National forests. Forest products are used on practically all farms.

TRANSPORTATION AND MARKETS

Farm to market transportation facilities, especially in the larger valleys, are good. One paved Federal highway and one paved State highway cross the county. Gravel roads, State or county, reach all parts of the county. Farms in the mountainous sections are not on improved roads. In 1950, 514 farms were reported on hard-surfaced roads, 896 on gravel, shell, or shale roads, and 195 on dirt or unimproved roads.

Mountain City, the county seat, is the principal market and shipping point for agricultural products. Johnson City, Elizabethton, and Bristol, which are in adjoining or nearby counties, are also important markets and trading centers for the farmers of Johnson County.

CULTURAL DEVELOPMENT AND IMPROVEMENT

All communities are provided with schools and churches. School bus and rural mail delivery services extend to practically all parts

[5a] See map published in 1941 by the Tennessee Valley Authority, Department of Forestry Relations: Areas Characterized by General Forest Types in the Tennessee Valley.

of the county. Telephone services are available in many places, and electric power facilities have been extended greatly in recent years. According to the 1950 census reports, 1,341 farm dwellings were lighted by electricity and 90 had telephones; 544 farms reported 608 automobiles, and 431 reported 446 motortrucks.

AGRICULTURE

Johnson County is predominantly agricultural. Farms are small, crops are well diversified, and production on most of the farms is primarily for home use. Owners operate about 93 percent of the farms in the county.

CROPS

Crops are grown in wide variety. The chief crops are corn, wheat, tobacco, snap beans, red clover, and lespedeza.

The acreage of the principal crops and number of fruit trees, compiled from United States Census reports, are given in table 2.

TABLE 2.—*Acreage of the principal crops and number of fruit trees and grapevines of bearing age in Johnson County, Tenn., in stated years*

Crop	1919	1929	1939	1949
	Acres	*Acres*	*Acres*	*Acres*
Corn for grain	11, 154	7, 920	7, 771	5, 306
Oats threshed	1, 799	1, 241	614	305
Wheat threshed	7, 628	2, 371	2, 370	1, 501
Rye threshed	253	170	257	410
Barley threshed	13	45	148	241
Buckwheat threshed	1, 569	698	476	(1)
Hay, total	7, 326	7, 997	6, 679	8, 426
Timothy and clover, alone or mixed	7, 151	7, 094	5, 108	5, 120
Lespedeza	(1)	(1)	910	1, 943
Alfalfa	4	30	45	450
Other cultivated grasses	96	717	384	530
Wild grasses	8	55	99	(1)
Small grains cut for hay	47	12	85	377
Annual legumes cut for hay	20	89	48	6
Silage and forage	4, 266	124	111	128
Potatoes	254	574	502	401
Sweetpotatoes	50	70	56	5
Other vegetables harvested for sale	(1)	116	1, 156	2, 160
Tobacco	8	530	851	1, 182
	Number [2]	*Number* [2]	*Number* [2]	*Number* [2]
Apple trees	59, 073	71, 975	46, 081	34, 491
Peach do	7, 258	5, 902	1, 627	515
Pear do	635	586	358	229
Plum and prune do	734	687	421	181
Cherry do	2, 450	2, 830	1, 956	1, 852
Grapevines	1, 541	1, 651	1, 501	1, 222

[1] Not reported.

[2] Of bearing age in the census year, which is 1 year later than the crop year indicated at the top of the column.

Corn.—Corn is the most important single crop in the county and is grown on practically all farms. Its total acreage has decreased in the past 30 years (table 2), but the average acre yield has increased from about 31 to 43 bushels. Although the crop is produced on practically all of the soils commonly tilled, most of it is grown on the soils of the bottom lands and colluvial lands. Fertilizers are used by some farmers, but the amount is generally small. Most of the corn is fed on the farms where it is grown.

Wheat.—Wheat is the most important of the small grains, but the acreage has decreased in recent years. The average yield in census years has steadily increased from 11 bushels an acre in 1919 to 15 bushels in 1949, mainly as a result of increased use of commercial fertilizers. At present most of the wheatland is fertilized with 150 to 400 pounds of a mixed fertilizer. Wheat is produced principally on the more productive soils of the uplands, terrace lands, (pl. 1, *A*), and old colluvial lands, but some is grown on soils of the bottom lands.

Other grains.—Oats, rye, barley, and buckwheat are much less important grain crops than wheat and corn. They have been used more commonly for winter cover, pasture, and grain in recent years. Practically all of the small grains are used on farms where grown.

Tobacco.—Burley tobacco has become important as a cash crop only within recent years. The present acreage is not large, but a great many farmers grow small patches. Most of the crop is grown on well-drained, permeable soils such as the Camp, Greendale, or Hayter, but some is grown with varying degrees of success on a wide variety of soils. Tobacco is usually heavily fertilized, and yields are high (pl. 1, *B*). The crop is marketed mainly in Johnson City.

Vegetables.—There were 2,160 acres of vegetables, mainly snap beans, harvested for sale in 1949, as compared with only 116 acres in 1929. Snap beans, the most important cash crop in the county at present, have been produced commercially for only a few years (pl. 2, *A*). They are grown mainly on the more productive soils of the valleys, such as Sequatchie, Hayter, and Staser; but some are grown on a wide variety of soils. In general the crop is fertilized heavily, and considerable effort is made to control insects and diseases. The crop is sold at auction in Mountain City and later trucked to distant markets. Vegetables in wide variety are grown for home use. Among these are potatoes, sweetpotatoes, okra, peas, lettuce, carrots, and cabbage. Some of these, especially potatoes and cabbage, are grown commercially to a limited extent.

Hay.—Clover and timothy, alone or mixed, are by far the most important hay crops in the county; lespedeza is second in acreage but is much less widely grown. Alfalfa or grasses are not important hay crops at present. The red clover is commonly grown on the better drained more productive soils, whereas lespedeza is grown under a wide range of fertility and drainage conditions. Lime and phosphate are generally required for the successful growth of red clover. Practically all hay and forage crops are fed on the farm where grown.

Pasture.—According to the 1950 census, there were 14,143 acres of plowable pasture in Johnson County and a considerable acreage

of nonplowable open and woodland pasture. Permanent pastures are largely confined to soils that are either too steep or too stony to be cultivated easily or are very shallow over bedrock. Some soils of the bottom lands that are too poorly drained for cultivation are also used for pasture. Rotation pastures, which furnish a considerable part of pasturage in this county, may be on any of the soils suitable for crop production. The more important pasture plants are bluegrass, orchardgrass, timothy, redtop, and white, red, and alsike clovers. The quality of pastures varies greatly according to character of the soil and to management. In general pasture management has not been so good as for field crops, but many farmers are now using lime and phosphate and are attempting to improve pastures by controlling grazing and weeds (pl. 2, *B*).

AGRICULTURAL PRACTICES

Agricultural practices vary greatly within the county according to differences in soil types, pattern of soil distribution, lay of the land, and size of farms. Modern machinery is generally used on the larger farms in the valleys, whereas much of the tillage in the hilly and steep areas and on small farms is done with one-horse implements and by hand labor. Small grains are generally harvested with grain binders, although small combines are being introduced where comparatively large acreages of grain are grown. Most of the corn is harvested by hand. Much of the small grain, such as wheat, barley, oats, and rye, is planted in the fall and harvested in June or July. Grasses and legumes are sown either in fall or in spring. Corn is usually planted in April or May.

A wide variety of crops are grown, but many farmers do not follow a systematic rotation. The particular need of the farmer or the general fertility level of the field usually determines the crop to be grown. However, a rotation consisting of corn, beans or tobacco, followed by a small grain, and then by red clover is commonly practiced on many farms.

The use of lime and commercial fertilizers has been steadily increasing during recent years. Mixed fertilizers, such as 3–9–6,[6] 5–10–5, or 4–12–4, 16- or 20-percent superphosphate, and basic slag are the most common fertilizing materials. They are used on all the field crops to some extent, but the larger part is used on tobacco and truck crops. The use of phosphatic fertilizers and lime on pastures and hay crops is becoming a common practice. The tobacco crop receives most of the barnyard manure.

LIVESTOCK AND LIVESTOCK PRODUCTS

Cattle, sheep, hogs, horses, mules, and chickens are the principal farm animals raised in Johnson County.

The number of livestock on farms in the county, compiled from Federal census reports, is given in table 3.

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[6] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

TABLE 3.—*Number of livestock on farms in Johnson County, Tenn., in stated years*

Livestock	1920	1930	1940	1950
Horses	2, 586	1, 556	1, 438	1, 566
Mules	569	340	[1] 159	119
Cattle	9, 936	8, 606	[1] 7, 756	11, 218
Sheep	3, 287	8, 266	[2] 3, 388	2, 419
Swine	4, 738	2, 596	[3] 2, 363	3, 374
Chickens	58, 101	[1] 43, 650	[3] 42, 670	[3] 50, 528
Other poultry	4, 565	([4])	[3] 1, 820	[3] 156
Beehives	1, 505	1, 686	1, 114	1, 637

[1] Over 3 months old.
[2] Over 6 months old.
[3] Over 4 months old.
[4] Not reported.

Cattle.—Dairy cattle and beef cattle are about equal in number. Most of the dairy cattle are in very small herds, nearly every farm having one or two. Dairy products are mainly for home use. The dairy cattle are chiefly purebred Jersey or Jersey grades. The beef cattle are chiefly Hereford and Angus breeds and are kept in large herds on the large farms, mainly in the valley sections of the county (pl. 3, *A*).

Hogs.—A relatively small number of hogs are raised at present, mainly for home use. Hogs for the market are raised by a few farmers, but they are not a major source of income on any of the farms. Poland China, Chester White, Duroc-Jersey, and Hampshire are the most popular breeds.

Sheep.—The number of sheep kept on the farms of Johnson County has varied greatly from one census year to another, but the trend is toward fewer sheep. Hampshire is the most common breed.

Poultry.—Chickens are an important source of income for most of the farms. White Leghorns, Rhode Island Reds, and Plymouth Rocks are the most common breeds. Chickens and eggs are used on the farm or sold locally. In 1949, a total of 1,739 turkeys was raised on 44 farms.

LAND USE, AND SIZE AND TYPES OF FARMS

In 1950, 109,947 acres, or about 58 percent of the land area, was in farms; the rest was largely in National forest. There were 1,791 farms, and the average size was 61.4 acres. The cropland in the county totaled 39,968 acres and averaged only about 22.3 acres per farm. About 23 percent of the land in farms was in cropland harvested and cropland not harvested and not pastured; 47 percent in land pastured; 26 percent in woodland; and 4 percent in all other uses.

The 1950 census classifies the farms of Johnson County by size and acreage as follows:

Size of farms (acres):	*Number*	*Acreage*
Under 10	247	1,272
10 to 29	511	9,496
30 to 49	374	14,214
50 to 69	232	13,331
70 to 99	167	13,617
100 to 139	108	12,541
140 to 179	58	9,124
180 to 219	24	4,698
220 to 259	15	3,519
260 to 499	41	14,184
500 to 999	9	5,954
1,000 and over	5	7,997

In the 1950 census the farms are classified by type as follows:

Type of farm:	*Number*
Field-crop farms other than vegetable, cotton cash-grain, and fruit-and-nut	444
General farms	239
Primarily crop	54
Primarily livestock	5
Crop and livestock	180
Livestock farms other than dairy and poultry	93
Vegetable farms	42
Dairy farms	40
Miscellaneous and unclassified farms	932

FARM POWER

Farm power in the past has been provided by horses and mules, but during the last decade tractors have replaced many draft animals, especially on the larger smoother farms of the valleys. Although only 136 tractors were reported on 121 farms in 1950, the change from draft animals to tractors as a source of farm power is progressing rapidly. Horses have always been much more popular than mules in this county.

FARM TENURE

According to the 1950 census, full owners operated 1,448 farms, part owners 222, managers 2, and tenants 119. In the common landlord-tenant agreement, the landlord furnishes the tenant with a house, work animals, and seed, and the tenant furnishes the labor. Fertilizer costs are divided according to the sharing of the crop. The tobacco crop is commonly shared equally, but the landlord usually receives two-thirds of the corn and small-grain crops, and the tenant one-third. Tenants who furnish labor, work animals, implements, seed, and all fertilizer receive two-thirds of all crops. Very little land is rented for cash, and definite cash rental prices have not been established.

SOILS OF JOHNSON COUNTY, THEIR USE AND MANAGEMENT

The soils of Johnson County differ greatly in color, texture, consistence, reaction, fertility, permeability, drainage, relief, stoniness, and depth to underlying material. All these characteristics affect the

productivity, workability, and conservability, and, accordingly, the agricultural uses to which the soils are suited.

The soils range in color from nearly white through gray, yellow, and brown to red. Colors intermediate between brown and gray predominate in the surface soils, whereas brown and yellow predominate in the subsoils. In texture and consistence the soils vary from loose incoherent sand to plastic clay. The surface soils are predominantly silt loam and loam. They are, for the most part, mellow and friable. The subsoils are mainly silty clay loam, clay loam, or silty clay and range from friable to strongly plastic.

The soils of the county are prevailingly hilly to steep but range from nearly level to very steep. The degree of erosion varies greatly. In large part, the soils are uneroded or only slightly eroded; some are moderately eroded, however, and others are severely eroded. Loose fragments of chert, cobbles, gravel, or stones that interfere materially with cultivation are common in many of the soils. Numerous outcrops of bedrock are mapped as stony land types.

The soils of the uplands and high terraces have been severely leached and are consequently acid in reaction and relatively low in fertility and organic matter. They differ one from another in fertility and in content of organic matter, even in the virgin state; and such differences have been further widened by cropping, erosion, and other artificially stimulated processes of impoverishment. In contrast to the soils of the uplands and high terraces (high benches), many of the soils of the bottoms and low terraces (second bottoms) are high in natural fertility, moderately well supplied with bases, especially lime, and are fairly well supplied with organic matter.

Chiefly because of the differences in characteristics, the soils differ one from another in their relative use suitability in the present agriculture. The soils that are highly productive, easy to work, and easy to conserve are physically well suited to agricultural uses; those that are low in productivity, difficult to work, and difficult to conserve are unsuited or very poorly suited. Most of the soils, however, are between these two extremes. About 17 percent of the county is thought to be suitable for crops, 33 percent for permanent pasture, and 50 percent only for forest.

SOIL SERIES AND THEIR RELATIONS

It is necessary to know the soils and to understand their relationships to each other in order to make full use of the soil survey. These relationships are more easily seen if the soils are placed in groups based on their position in the landscape. The soils of Johnson County are placed in four groups: (1) Soils of the uplands, (2) soils of the terrace lands, (3) soils of the colluvial lands, and (4) soils of the bottom lands.

The grouping given in table 4 will aid in the identification of the soil series and show their relation to other series, position in the landscape, drainage, and parent rock.

TABLE 4.—*A grouping of the soil series of Johnson County, Tenn., to show their relation to topographic position, parent material, relief, and drainage*

SOILS OF THE UPLANDS

Series	Parent material	Relief	Drainage	Remarks
	Residual material derived from the weathering of—			
Hagerstown	Dolomitic limestone [1]	Rolling to steep	Well drained	Brown to dark reddish-brown soils of the lowland belts; relatively deep profiles; somewhat eroded.
Elliber	Cherty dolomitic limestone [2]	do	Well drained to excessively drained.	Light brownish-gray to brownish-yellow soils on cherty slopes of the lowland belts; relatively deep profiles.
Teas	Red shale with thin lenses of dolomite.[3]	Rolling to very steep.	Excessively drained to well drained.	Reddish soils on rounded or domelike hills in the lowland belts; profiles relatively shallow and indistinct due to rapid geologic erosion; runoff rapid to very rapid.
Litz	Green shale, mainly, with thin lenses of dolomite.[4]	do	do	Brownish soils on rounded or domelike hills in lowland belts; shallow soils with indistinct profiles due to rapid geologic erosion; occur in complex association with Teas soils.
Matney	Quartzite, shale, siltstone, conglomerate, and sandstone.	Rolling to hilly	Well drained	Brown relatively deep soils on mountain uplands; fairly distinct profiles; surface soils somewhat eroded.
Clifton	Hornblende gneiss, hornblende schist, and diorite, with some interbedded mica schist and mica gneiss.	Hilly	Well drained to excessively drained.	Brown to dark reddish-brown relatively deep soil on mountain uplands; distinct profile development; similar to Hagerstown soils of the lowland belts; some erosion.
Perkinsville	Granite, granite gneiss, and schist.	do	Well drained	Grayish-brown to yellowish-brown soils on smoother mountain uplands; profiles relatively deep and have fairly distinct horizons; some areas eroded.

Ramsey	Quartzite, shale, siltstone, conglomerate, and sandstone.	Hilly to very steep	Excessively drained	Brown to light yellowish-brown stony relatively shallow soils on predominantly very steep mountain uplands; profiles indistinct due to rapid geologic erosion; runoff rapid to very rapid.
Porters	Mica gneiss and mica schist, with some granite, hornblende gneiss, hornblende schist, and diorite.	Hilly to steep	Excessively drained to well drained.	Dark-brown to yellowish-brown friable relatively shallow soils on predominantly steep mountain uplands; profile horizons not distinctly developed; about half the area stony; some erosion.
Ashe	Granite, granite gneiss, and schist.	Hilly to very steep	Excessively drained	Grayish-brown to light yellowish-brown relatively shallow soils on predominantly steep mountain uplands; no distinct profile horizon development; associated with Porters and Ramsey soils; more than half of area stony; some erosion.
Soils of the Terrace Lands				
Masada	Old general alluvium derived from uplands underlain mainly by— Granite, gneiss, and schist	Undulating to hilly	Well drained	Dark-brown or brown to yellowish-brown soils on high stream terraces; profiles distinctly developed, relatively deep, and free of mottlings to a depth of 30 inches or more.
Sequatchie	Quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Undulating to rolling.	do	Brown or dark grayish-brown to yellowish-brown soils on low stream terraces; fairly distinct relatively deep profiles free of mottlings to a depth of about 30 inches.

See footnotes at end of table.

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TABLE 4.—*A grouping of the soil series of Johnson County, Tenn., to show their relation to topographic position, parent material, relief, and drainage*—Continued

SOILS OF THE TERRACE LANDS—Continued

Series	Parent material	Relief	Drainage	Remarks
Whitwell	Quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Undulating	Imperfectly drained	Brown soil on low stream terraces; relatively deep distinctly developed profile; mottled below about 12 inches.
Tyler	do	Nearly level; some depressions.	Somewhat poorly drained.	Gray soil on low stream terraces; relatively deep profile with a pan layer beginning at about 18 inches; profile mottled below 6 to 8 inches.
SOILS OF THE COLLUVIAL LANDS				
Greendale	Local alluvial and colluvial accumulations washed from uplands underlain by—Cherty dolomitic limestone	Gently sloping	Well drained to imperfectly drained.	Light brownish-gray to brown soil on foot slopes and near drainageways in the lowland belts; profile generally relatively deep but has indistinct textural horizons because of the short time parent material has been in place; faintly mottled below about 20 inches but distinctly mottled below about 32 inches.

Camp	Red shale, mainly	do	do	Dusky-red to reddish-brown soil on foot slopes and near drainageways in the lowland belts; profile relatively deep in most places but has indistinct textural horizons because of the short time parent materials have been in place; distinct mottling below about 30 inches.
Shouns	Old colluvial and local alluvial accumulations from uplands underlain chiefly by red shale. Colluvial and local alluvial accumulations washed or rolled from uplands underlain chiefly by—	Rolling to hilly	Well drained	Dusky-red to yellowish-brown soils on foot slopes in the lowland belts; relatively deep well-developed profiles showing no mottling.
Jefferson	Quartzite, shale, siltstone, conglomerate, and sandstone.	Rolling to steep	Well drained to excessively drained.	Grayish-brown to light yellowish-brown soils at the base of upland slopes and on valley floors; profiles relatively deep and mottled in the lower part; in nearly all areas rock fragments are on the surface and mixed through the profile.
Hayter	Quartzite, shale, siltstone, congolmerate, and sandstone; limestone or other calcareous influence.	Undulating to steep.	Well drained	Dark-brown or brown to yellowish-brown soils at the base of upland slopes and on valley floors; profiles relatively deep and mottled in the bottom layer; in a great part of the soil area rock fragments are strewn over the surface and mixed through the profile.

See footnotes at end of table.

TABLE 4.—*A grouping of the soil series of Johnson County, Tenn., to show their relation to topographic position, parent material, relief, and drainage*—Continued

SOILS OF THE COLLUVIAL LANDS—Continued

Series	Parent material	Relief	Drainage	Remarks
Tusquitee	Colluvial and local alluvial accumulations washed or rolled from uplands underlain chiefly by— Granite, gneiss, and schist	Rolling to hilly	do	Brown to dark-brown or yellowish-brown soils at the base of upland slopes underlain mainly by granite, gneiss, and schist; profiles relatively deep and free of mottlings to a depth of 30 inches or more; in more than half the total area the soils have rock fragments on the surface and mixed through the profile.
SOILS OF THE BOTTOM LANDS				
Staser	Recent general alluvium derived from uplands underlain mainly by— Quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Nearly level	Well drained	Brown or dark-brown soil on first bottoms subject to overflow; profile free of mottlings to a depth of about 36 inches.
Hamblen	do	do	Imperfectly drained	Brown to grayish-brown soil on first bottoms subject to overflow; profile mottled below depths of 14 to 18 inches.

Prader	do	Nearly level; many areas in depressions.	Poorly drained	Gray to dark-gray soil on first bottoms subject to overflow; mottling in surface soil and subsoil.
Congaree	Granite, gneiss, and schist, mainly.	Nearly level	Well drained	Dark-brown to brown soil on first bottoms subject to overflow; free of mottlings to a depth of 24 inches or more.
Chewacla	do	do	Imperfectly drained	Grayish-brown to brown soil on first bottoms subject to overflow; profile mottled below 12 to 18 inches; more than half the total extent of the soil is gravelly.
Dunning	Quartzite, shale, siltstone, conglomerate, and sandstone; influenced by calcareous material from shale or limestone.	Nearly level; some areas in depressions.	Poorly to imperfectly drained.	Dark-gray or black soil on first bottoms subject to overflow; faintly mottled below a depth of about 18 inches.

[1] The rock from which the Hagerstown soils are derived in this county is called dolomitic limestone in the report. It is part of the Shady dolomite of the Lower Cambrian series (*3*). The Shady dolomite consists largely of blue-gray and white dolomite but includes a small amount of limestone and a few beds of shale. Blue dolomite is commonest and is dark to light blue-gray. Nodules of chalcedonic chert are abundant in some layers. Most of the white dolomite is much purer than any of the dolomite in the Shady formation. Samples collected by G. R. Gwinn and analyzed by D. F. Farrar of the Tennessee Division of Geology contain 93.66 to 94.48 percent $CaMg(CO_3)_2$, and 98.29 to 99.20 percent of total carbonates. It is thought that the Hagerstown soils have formed from the purer part of the Shady dolomite.

[2] The rock that gives rise to the Elliber soils is called cherty dolomitic limestone in the report. This rock is thought to be mostly blue dolomite of the Shady dolomite described in footnote 1 of this table. Chert is abundant in some of this dolomite. Jasperoid, a variety of chert, also occurs in residual clay from dolomite. The chert present as fragments in the Elliber soils is derived mostly from these two sources.

[3] The rock giving rise to the Teas soils is dominantly red shale containing some dolomite. This shale is part of the Rome formation of the Lower and Middle Cambrian series (*3*). The Rome formation consists of red shale and siltstone, some green shale, and some dolomite. A large part is red, maroon, or brown shale. Green argillaceous sericitic shale is also present, and is associated with dolomitic shale or shaly dolomite. Interbedded with the shale are beds of maroon-red, brown, and greenish-brown siltstone, which in places grade into fine-grained sandstone. Interbedded, especially with the green shale, are numerous beds of light-gray shaly dolomite, mostly less than 2 feet thick.

[4] The rocks from which the Litz soils have formed are thought to be mostly green shale and some dolomite. These rocks are part of the Rome formation described in connection with the Teas soils in footnote 3 of this table. The Litz soils are not mapped separately but are mapped with Teas soils in the Teas-Litz soil complex.

SOILS OF THE UPLANDS

The soils of the uplands are in the higher lands above the stream valleys. The group consists of members of the Hagerstown, Elliber, Teas, Litz, Ramsey, Matney, Porters, Clifton, Ashe, and Perkinsville series. These soils have developed from materials weathered from the underlying rocks. The properties of the soils are generally closely associated with the character of the underlying rocks from which the parent materials have been weathered. In Johnson County there are five major classes of rocks: (1) Dolomitic limestone, (2) shale, (3) quartzite, (4) granite, and (5) gneiss.

The Hagerstown and Elliber soils, which are in the larger valleys, are moderately deep to deep soils underlain by dolomite limestone. The Hagerstown soils have brown or dark-brown to dark reddish-brown surface soils and reddish-brown to red subsoils and are relatively chert free; the Elliber soils are generally cherty and have light-colored surface soils and brownish-yellow to reddish-yellow or light yellowish-brown subsoils.

The Teas and Litz soils are also on low hills in the larger valleys, but they are shallow and shaly and were derived from material weathered mainly from shale. The Teas soils are reddish colored, whereas the Litz soils are mainly light yellowish brown in the surface soil and brownish yellow or yellow in the subsoil.

The Ramsey and Matney soils are on the mountain slopes and ridge crests underlain by quartzite, shale, siltstone, conglomerate, and sandstone. These soils have brown to light yellowish-brown or pale-brown surface soils and yellowish-brown to brownish-yellow or pale-brown subsoils. They differ chiefly in depth and degree of differentiation of profile layers. The Ramsey soils are mainly on steep slopes and have shallow profiles with indistinct surface soil and subsoil layers. The Matney soils are chiefly on ridge crests and less steeply sloping areas and have moderately deep profiles with distinct surface soils and subsoil layers.

The Porters, Clifton, Ashe, and Perkinsville soils are also in the mountain uplands. The Porters and Clifton soils are underlain by different proportions of gneiss and schist and some granite and diorite. The Ashe and Perkinsville soils are underlain by granite, granite gneiss, and schist. These mountain soils are differentiated chiefly by depth to bedrock, distinctness of horizons, and color of surface soil and subsoil layers.

The Perkinsville and Ashe are light-colored soils with grayish-brown to pale-brown or yellowish-brown surface soils and light-brown to yellowish-brown or brownish-yellow subsoils. The Ashe soils are shallow and excessively drained and are chiefly on steep slopes; the Perkinsville soils are deep and well drained and generally have milder slopes, and heavier textured subsoils.

SOILS OF THE TERRACE LANDS

In the geologic past, the present rivers and streams flowed at considerably higher levels; and at these levels, they deposited gravel, sand, and clay on their flood plains. During the progress of stream cutting over a great number of years, the channels were gradually deepened and new flood plains were formed at the lower levels. Remnants of the older higher lying flood plains were left above the overflow stage of

the present streams and are now the terrace lands. Geologically they consist of general stream alluvium that lies above the overflow stage of the present streams. They are frequently referred to as second bottoms or benches.

Soils of the terrace lands consist of members of the Masada, Sequatchie, Whitwell, and Tyler series. These soils differ principally in color, texture, consistence, drainage, and source of parent materials. The Masada soils are on high stream terraces and are derived from old mixed alluvium, mainly from granite, gneiss, and schist materials. The Sequatchie, Whitwell, and Tyler soils are on low stream terraces and are derived from old alluvium washed chiefly from quartzite, shale, siltstone, conglomerate, and sandstone, but they include some material from dolomite or dolomitic limestone and calcareous shale in most places. The Sequatchie soils are the well-drained brown to yellowish-brown soils, the Whitwell soil the brown imperfectly drained soil, and the Tyler soil the more poorly drained gray soil of this group.

SOILS OF THE COLLUVIAL LANDS

The soils of the colluvial lands are (1) along small drainageways, (2) at the base of the upland slopes, and (3) on small, sloping alluvial-colluvial fans where the small streams have deposited materials over the broad plains of larger streams. Their parent materials are derived from soil materials and rock fragments washed and rolled from the adjacent slopes.

This group is composed of members of the Greendale, Camp, Shouns, Jefferson, Hayter, and Tusquitee series. The Greendale soil is derived chiefly from materials washed from the cherty light-colored Elliber soils. It has a light brownish-gray to brown surface soil and yellowish-brown or brownish-yellow subsoil. In most places the material is mottled below a depth of about 20 inches.

The Shouns and Camp soils are characterized by their (dusky-red) color and the numerous shale fragments throughout the profile. They are derived chiefly from materials washed from Teas soils, but the Litz soils have also contributed material in most places. In the Shouns soils the surface soil and subsoil layers have a distinct difference in color and texture, whereas in the Camp soil color and texture are relatively uniform throughout. The Shouns soils have dusky-red to yellowish brown silt loam surface soil and strong-brown or yellowish-brown silty clay loam or silty clay subsoil. The Camp soil has a dusky-red to reddish-brown silt loam profile, but some difference in color and texture is recognizable between the layers in most places.

The parent materials of the Hayter and Jefferson soils are chiefly from quartzite shale, siltstone, conglomerate, and sandstone, but that of the Hayter soils is influenced by material from limestone or calcareous shale in most places. The Jefferson soils are light colored; they have grayish-brown to light yellowish-brown surface soils and yellowish-brown to brownish-yellow or light yellowish-brown subsoils. The Hayter soils have dark-brown or brown to yellowish-brown surface soils and yellowish-brown to strong-brown subsoils.

The Tusquitee soils are similar to the Hayter soils in color, but their parent materials are from uplands underlain chiefly by granite, gneiss, and schist.

SOILS OF THE BOTTOM LANDS

The bottom lands are the flood plains or the nearly level areas along the streams that are subject to flooding. The material giving rise to the soils in the bottom lands has been carried there by the streams, and its character depends largely upon the source in the higher lying lands and the rate at which the water was moving when the material was deposited. The material from which the soils in the bottoms are developing has not lain in place long enough to have well-defined surface soils and subsoil layers, such as are found in most of the soils of the uplands and terraces.

This group consists of soils of the Staser, Hamblen, Prader, Congaree, Chewacla, and Dunning series. The alluvium from which the Staser, Hamblen, and Prader soils are formed has washed from soils of the uplands, such as Ramsey, Teas, and Litz, but it is influenced in most places by dolomitic materials. The differences in these soils are chiefly due to differences in drainage. The Staser soil is well drained and predominantly brown throughout the profile; the Hamblen soil is imperfectly drained and is brown to grayish brown, mottled with gray, brown, and yellow below 14 to 18 inches; the Prader soil is poorly drained and gray to dark gray and mottled in the surface soil and gray mottled in the subsoil.

The Congaree and Chewacla soils consist of material washed from soils of the uplands, such as Porters and Ashe, that have developed mainly from granite gneiss and schist. The Congaree soil is well drained and predominantly brown throughout the profile; the Chewacla are imperfectly drained grayish-brown to brown soils mottled with gray and brown below 12 to 18 inches. The Dunning is a dark-gray or black, poorly drained soil consisting of materials ordinarily derived mainly from limestone, but in this county it includes considerable material from uplands underlain by quartzite, shale, siltstone, conglomerate, and sandstone.

DESCRIPTION OF THE SOILS

In the following pages the soils of Johnson County are described in detail and their relation to agriculture is set forth to the extent that present knowledge permits. The acreage and proportionate extent of these soils are listed in table 5, and their location and distribution are represented graphically on the soil map.

TABLE 5.—*Approximate acreage and proportionate extent of the soils mapped in Johnson County, Tenn.*

Soil	Acres	Percent
Ashe loam:		
Eroded steep phase	4, 365	2. 3
Steep phase	1, 703	. 9
Ashe stony loam:		
Eroded hilly phase	458	. 2
Eroded steep phase	2, 363	1. 2
Hilly phase	146	. 1
Steep phase	4, 309	2. 3
Very steep phase	543	. 3
Camp silt loam	1, 244	. 7

TABLE 5.—*Approximate acreage and proportionate extent of the soils mapped in Johnson County, Tenn.*—Continued

Soil	Acres	Percent
Chewacla gravelly fine sandy loam	282	0.1
Chewacla loam	130	.1
Clifton clay loam, eroded hilly phase	132	.1
Cobbly alluvium, Hamblen and Sequatchie soil materials	3,196	1.7
Congaree fine sandy loam	69	(1)
Dunning silt loam	389	.2
Elliber cherty silt loam:		
Eroded hilly phase	1,330	.7
Eroded rolling phase	386	.2
Eroded steep phase	2,822	1.5
Hilly phase	622	.3
Steep phase	816	.4
Greendale silt loam	226	.1
Hagerstown silty clay loam:		
Eroded hilly phase	372	.2
Eroded rolling phase	275	.1
Eroded steep phase	1,029	.5
Hamblen loam	1,340	.7
Hayter loam:		
Eroded hilly phase	167	.1
Eroded rolling phase	1,856	1.0
Hilly phase	104	(1)
Undulating phase	331	.2
Hayter stony loam:		
Eroded hilly phase	3,686	1.9
Eroded rolling phase	2,804	1.5
Eroded steep phase	3,047	1.6
Hilly phase	1,408	.7
Rolling phase	280	.1
Steep phase	2,369	1.2
Undulating phase	746	.4
Jefferson loam, eroded rolling phase	320	.2
Jefferson stony fine sandy loam:		
Eroded rolling phase	349	.2
Eroded steep phase	477	.2
Hilly phase	1,150	.6
Rolling phase	171	.1
Steep phase	2,786	1.5
Jefferson stony loam:		
Eroded hilly phase	2,615	1.4
Eroded rolling phase	2,483	1.3
Eroded steep phase	1,428	.7
Hilly phase	2,868	1.5
Rolling phase	873	.5
Steep phase	4,050	2.1
Made land	56	(1)
Masada silt loam:		
Eroded hilly phase	106	(1)
Eroded rolling phase	156	.1
Undulating phase	45	(1)
Matney loam:		
Eroded hilly phase	450	.2
Eroded rolling phase	264	.1
Mine pits	21	(1)
Perkinsville loam:		
Eroded hilly phase	1,509	.8
Hilly phase	285	.1

[1] Less than 0.1 percent.

TABLE 5.—*Approximate acreage and proportionate extent of the soils mapped in Johnson County, Tenn.*—Continued

Soil	Acres	Percent
Porters loam:		
Eroded hilly phase	476	0. 2
Eroded steep phase	1, 710	. 9
Steep phase	250	. 1
Porters stony loam:		
Eroded steep phase	1, 077	. 6
Steep phase	396	. 2
Prader silt loam	622	. 3
Ramsey stony loam:		
Hilly phase	12, 755	6. 7
Steep phase	63, 350	33. 1
Very steep phase	1, 555	. 8
Sequatchie cobbly loam:		
Eroded rolling phase	296	. 2
Undulating phase	1, 845	1. 0
Sequatchie loam, undulating phase	288	. 2
Sequatchie silt loam, undulating phase	834	. 4
Shouns silt loam:		
Eroded hilly phase	682	. 4
Eroded rolling phase	1, 678	. 9
Staser fine sandy loam	151	. 1
Stony colluvium:		
Jefferson soil material	3, 003	1. 6
Tusquitee soil material	512	. 3
Stony rough land:		
Ashe and Porters soil materials	925	. 5
Elliber and Teas soil materials	2, 053	1. 1
Ramsey soil material	7, 144	3. 7
Teas-Litz shaly silt loams, very steep phases	695	. 4
Teas-Litz shaly silty clay loams:		
Eroded hilly phases	3, 387	1. 8
Eroded steep phases	7, 619	4. 0
Eroded rolling phases	563	. 3
Teas-Litz silt loams:		
Hilly phases	1, 050	. 5
Steep phases	3, 680	1. 9
Teas shaly silt loam, steep phase	639	. 3
Teas shaly silty clay loam:		
Eroded hilly phase	249	. 1
Eroded steep phase	601	. 3
Tusquitee loam:		
Eroded hilly phase	438	. 2
Eroded rolling phase	327	. 2
Tusquitee stony loam:		
Eroded hilly phase	917	. 5
Eroded rolling phase	681	. 4
Tyler silt loam	122	. 1
Whitwell silt loam	943	. 5
Total	191, 360	100. 0

Ashe loam, steep phase (25–60% slopes) (AB).—This is a light-colored excessively drained soil of steep mountain slopes. It has developed from the residuum of low-micaceous granite, granite gneiss, and schist. It differs from the Porters soils principally in being more yellowish and less brownish, and from Perkinsville soils in being steeper and in having a subsoil not distinctly heavier than the surface soil.

This soil is in small irregularly shaped areas widely distributed throughout the southeastern part of the county. The greater part of the acreage is in the Ashe-Tusquitee-Perkinsville soil association.

Profile description:

0 to 10 inches, grayish-brown to pale-brown friable loam; in wooded areas surface 2 inches is dark grayish brown.
10 to 20 inches, light yellowish-brown to brownish-yellow friable somewhat gritty heavy loam.
20 inches +, light yellowish-brown, coarsely mottled with yellowish-gray, gritty loam or fine sandy loam and partially weathered rock; bedrock at depths varying from 2 to 5 feet.

The entire profile is medium to strongly acid and apparently low in organic matter. A few stones and an occasional bedrock outcrop are to be expected in areas of this soil but not in quantities sufficient to interfere materially with tillage. The porous, friable soil permits easy penetration of plant roots and free movement of air and moisture. Runoff is very rapid and internal drainage is rapid. The water-supplying capacity is low.

Boundaries between the Ashe soils and other soils of the mountains are not distinct. Therefore, small areas of associated soils are included. Ashe loam, steep phase, as mapped, includes areas of Porters loam, steep phase. Small areas of Ashe stony loam, steep phase, are also included.

Use suitability.—All of this soil is in the type of forest that follows an incomplete timber harvest. A part of this soil is within the Cherokee National Forest. Because of the steep slopes, difficulty of controlling runoff and erosion and conserving fertility, and general inaccessibility, the best use for this soil on most farms is for forest. Under a high level of management that includes application of lime and phosphate and careful control of grazing, the soil probably could be maintained in permanent pasture. For a discussion of use and management, see group 13 in the section on Use and Management of Soils.

Ashe loam, eroded steep phase (25–60% slopes) (AA).—This light colored excessively drained soil occurs on steep mountain slopes. It has developed from the residuum of granite, granite gneiss, and schist. This phase has been cleared of its native vegetation, and about 25 to 75 percent of the original surface soil has been removed by erosion. It differs from Ashe loam, steep phase, in being eroded, and from Ashe stony loam, eroded steep phase, in being virtually stone-free.

Ashe loam, eroded steep phase, occurs in irregularly shaped areas in close association with Ashe stony loam, eroded steep phase, throughout the areas underlain by granite.

The present surface layer is variable in thickness and color because the thin dark-colored surface layer of higher organic-matter content has been removed by erosion or mixed with other layers in the plow layer. The present surface layer is grayish brown to light yellowish brown and from about 2 to 10 inches thick.

This soil is strongly acid and low in organic matter and plant nutrients. There are a few stones and occasional bedrock outcrops. The soil is very permeable and allows easy penetration by roots, air, and water. The water-supplying capacity is low.

This soil, as mapped, includes small areas of associated soils. Soils of the Porters series as well as other soils of the Ashe series are included. Some areas of soil that differ chiefly in having a reddish subsoil are also included.

Use suitability.—All of this soil is cleared and is being used mainly for crop and pasture plants common to the area. A considerable part of the soil is idle each year, and a part has been abandoned and is reverting to forest.

The steep slopes limit the use of farm machinery, increase runoff and erosion, and make the problem of conservation difficult. This soil is best suited physically to forest. However, under some conditions, especially on the lower or milder slopes, it might be practical to use it for pasture (pl. 3, *B*). To insure satisfactory pasture, moderate to heavy applications of lime and phosphate will be required. Grazing will need to be carefully controlled so as to maintain a good sod at all times. If properly limed and phosphated, the soil produces good mixed grass and legume pasture. For a discussion of use and management, see group 13 in the section on Use and Management of Soils.

Ashe stony loam, steep phase (25–60% slopes) (Af)—This is a light-colored excessively drained stony soil on steep mountain slopes. It has developed from the residuum of granite, granite gneiss, and schist. It differs from Ashe loam, steep phase, chiefly in being more stony. It is also shallower to bedrock and has more bedrock outcrops.

Ashe stony loam, steep phase, occurs in both large and small irregularly shaped areas in association with the Porters, Perkinsville, Tusquitee, and other Ashe soils. It is largely confined to the eastern part of the county on the Ashe-Tusquitee-Perkinsville soil association.

Profile description:

0 to 10 inches, grayish-brown to pale-brown very friable stony loam; in wooded areas a thin 1- to 2-inch surface layer is stained dark with organic matter.
10 to 18 inches, light yellowish-brown to brownish-yellow friable heavy stony loam.
18 inches +, highly mottled gritty loam mixed with partially weathered rock fragments; bedrock at depths of 1 to 5 feet.

The entire profile is medium to strongly acid, and the content of organic matter appears to be low, except in the thin surface layer in wooded areas. The content of plant nutrients is relatively low. Fragments of stone, both large and small, are on the surface and throughout the profile and interfere with tillage. The porous friable soil permits easy penetration of plant roots and free movement of air and moisture. Both runoff and internal drainage are rapid. The water-supplying capacity is low or very low.

Boundaries between this and other soils of the mountains are not distinct, and small areas of Porters, Perkinsville, and other Ashe soils are therefore included with this soil as mapped.

Use suitability.—Practically all of Ashe stony loam, steep phase, is in forest at present. A considerable part is within the Cherokee National Forest. Most of the privately owned forests have been cut over several times, and the present stand is small and includes many cull trees. Because of steepness, stoniness, low fertility, and low water-holding capacity, this soil is considered unsuited to crops and poorly suited to pasture. It is probably best used for forests on most farms. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Ashe stony loam, eroded steep phase (25–60% slopes) (Ad).—This is a light-colored excessively drained stony soil on steep moun-

tain slopes. It is derived from materials weathered from granite, granite gneiss, and schist. It has been cleared and cultivated, and differs from Ashe stony loam, steep phase, in being eroded.

This soil is widely distributed throughout the Ashe-Tusquitee-Perkinsville soil association. It is closely associated with Perkinsville, Tusquitee, Porters, and other Ashe soils.

Because of the loss of a considerable part of the surface soil, Ashe stony loam, eroded steep phase, has a slightly heavier surface layer than Ashe stony loam, steep phase. It is also lower in organic matter, more droughty, more susceptible to further damage by erosion, and generally not so well supplied with plant nutrients.

Use suitability.—All of this soil is cleared and has been used for crops and pasture. At present, much of it is either idle or in permanent pasture; a very small part is used for crops. Yields are commonly very low. A part of the soil is within the Cherokee National Forest and a forest cover is becoming reestablished on most areas.

Owing to its steepness and stoniness, the soil is very difficult to work with heavy farm machinery. Erosion is difficult to control, and a decrease in fertility has resulted from the loss of soil material. Because the soil is difficult to work, difficult to conserve, and low in productivity for the common crops of the area, it is best suited to forest. Permanent pastures, without amendments, usually produce low yields of poor quality. In practically all places, applications of lime and phosphate would increase both yield and quality of pasture. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Ashe stony loam, hilly phase (12–25% slopes) (AE).—This light-colored excessively drained stony soil occurs in hilly mountain areas. The parent materials have weathered from granite, granite gneiss, and schist. The native forest was chiefly deciduous, although it included many coniferous trees. This soil differs from Ashe stony loam, steep phase, in having a milder relief. In addition it is somewhat deeper than the steep phase, has a heavier subsoil in many places that is generally thicker, and has a surface soil that may be slightly darker. Like the steep phase it occurs in forested areas.

Ashe stony loam, hilly phase, is in relatively small, irregularly shaped areas largely confined to the Ashe-Tusquitee-Perkinsville soil association area.

Profile description:

0 to 10 inches, grayish-brown to pale-brown friable stony loam.
10 to 30 inches, light yellowish-brown to brownish-yellow friable heavy stony loam or stony clay loam.
30 inches +, highly mottled loam mixed with partially weathered rock fragments; bedrock at depths of 1 to 5 feet.

The entire profile is medium to strongly acid, and the content of organic matter appears to be low except in the thin surface layer in wooded areas. The content of plant nutrients is low. Stone fragments are on the surface and throughout the soil in sufficient quantities to interfere materially with tillage. The soil is very permeable to air, roots, and water. Runoff and internal drainage are rapid to very rapid. The water-supplying capacity is low.

The boundaries between this and other mountain soils are indistinct; consequently, this separation includes small areas of the associated

soils. It also includes some areas of soil that differ in having a reddish subsoil.

Use suitability.—Although this soil is in forest at the present time, accessible areas are considered suitable for pasture. Without amendments, however, low yields of low quality can be expected. Available evidence indicates that the soil can be safely used for crop production if the management includes stripcropping and proper use of amendments. For a discussion of use and management, see group 10 in the section on Use and Management of Soils.

Ashe stony loam, eroded hilly phase (12–25% slopes) (Ac).—This is a light-colored excessively drained stony soil on hilly mountainous areas. It has formed from materials weathered from granite, granite gneiss, and schist. It differs from Ashe stony loam, hilly phase, chiefly in having lost much of the original surface soil. The remaining surface soil is slightly heavier, more variable in color, and lower in plant nutrients and organic matter than that of the hilly phase.

This is an inextensive soil widely distributed in small areas throughout the Ashe-Tusquitee-Perkinsville soil association. It is closely associated with other Ashe soils and with Porters, Perkinsville, and Tusquitee soils.

The soil is medium to strongly acid and low in organic matter, plant nutrients, and water-supplying capacity. The stone fragments on the surface and throughout the soil materially interfere with tillage. The soil is very permeable, and runoff and internal drainage are rapid to very rapid.

As mapped, this soil includes small areas of the associated upland soils. Some areas are included that differ in having a reddish subsoil.

Use suitability.—All of this soil is cleared and has been used for crops and pasture, but a considerable part is now idle. A part of this soil, particularly that on milder slopes and in the less stony areas, is moderately well suited to a long rotation in which close-growing crops, including small grains and deep-rooted legumes, are favored. It has been demonstrated that the soil can be maintained under more intensive usage, provided stripcropping and adequate fertilization are practiced. The steeper areas can be maintained in well-managed permanent pasture. Adequate amendments, particularly lime and phosphate, are generally required to obtain satisfactory pasture. For a discussion of use and management, see management group 10 in the section on Use and Management of Soils.

Ashe stony loam, very steep phase (60+% slopes) (Ag).—Like Ashe stony loam, steep phase, this is a light-colored excessively drained stony soil of the mountains. It differs from the steep phase chiefly in having steeper slopes. In addition it is somewhat more shallow over bedrock and has more numerous bedrock outcrops. Some areas of soil relatively free of stone, as well as a small acreage of a darker soil, are included.

This soil occurs mainly in small areas on the very steep slopes around the heads of drains. It is mainly confined to the Ashe-Tusquitee-Perkinsville soil association.

Use suitability.—The soil is practically all in forest. Because of its very steep slopes and high degree of stoniness, it would be very difficult to work and extremely difficult to conserve if used for either crops or pasture. It is also poorly suited to forest, but this is its best

use on most farms. For a discussion of use and management, see group 14 in the section, Use and Management of Soils.

Camp silt loam (2–7% slopes) (CA).—This is a dusky-red well-drained to imperfectly drained soil of the colluvial lands. It consists of recently deposited local alluvial or colluvial materials washed mainly from Teas soils, which are derived mainly from red shale. The soil is relatively uniform in color and texture throughout. The Shouns soils (dusky-red soils developed on older colluvial lands) differ in having surface and subsoil layers that have well-defined differences in color and texture.

The Camp soil is in small irregularly shaped areas widely distributed throughout the Teas-Litz-Shouns-Camp soil association. It is closely associated with Teas, Litz, Shouns, Hayter, and Sequatchie soils.

Profile description:

0 to 12 inches, dusky-red to reddish-brown friable silt loam.
12 to 30 inches, reddish-brown to weak-red friable silt loam to silty clay loam.
30 to 48 inches +, yellowish-red to yellowish-brown friable shaly silt loam or silty clay loam, mottled with yellow, gray, and brown in most places.

This soil is slightly to medium acid and is apparently moderately well supplied with organic matter. It is relatively stone-free but does contain throughout its profile varying amounts of purple, green, and yellow shale fragments that in most places increase with depth. The soil is permeable and as a result has good plant-root development and very satisfactory air and moisture movement. Water is readily absorbed and well retained. The lay of the land is favorable for easy tillage, and runoff is medium. The water-supplying capacity is very high.

Camp silt loam, as mapped, includes some small areas of soils that differ in having a heavier, less friable subsoil. A few small areas are also included that differ in having a heavier, less friable subsoil, or a somewhat steeper slope.

Use suitability.—Practically all of this soil is cleared and used intensively for the production of the common crops. A very small part is either idle or in pasture.

The soil is well suited to intensive use for crop production. Although fair crop yields are obtained without fertilization or crop rotation, use of a short rotation that includes a legume and proper application of amendments is generally required for continued high production. The soil is not susceptible to erosion but in most places receives material washed from the adjacent slopes. This addition of fresh material tends to maintain the plant-nutrient and organic-matter levels. Large depositions from severely eroded slopes, however, sometimes injure the growing crop and temporarily lower the productivity of the soil for most crops. For a discussion on use and management, see group 2 in the section on Use and Management of Soils.

Chewacla loam (0–2% slopes) (Cc).—This is an imperfectly drained soil of the bottom lands. It consists of general alluvium washed mainly from uplands underlain by granite, gneiss, and schist. In most places it has a slight admixture of material washed from uplands underlain by quartzite, shale, siltstone, conglomerate, and sand-

stone. It is made up of materials similar to those of the Congaree soil; the differences between the two soils result chiefly from differences in drainage. It is less well drained than the Congaree soil.

This soil is along most of the streams in the Ashe-Tusquitee-Perkinsville and Porters-Tusquitee-Clifton soil associations and along the streams flowing from those areas. The larger areas, however, are on the flood plains of the Watauga River.

Profile description:

0 to 14 inches, grayish-brown to brown very friable loam.
14 to 36 inches, light yellowish-brown to brown friable loam to loamy fine sand, mottled with gray.
36 inches +, gray gravelly loam to loamy fine sand.

The soil is medium to strongly acid, has a moderate organic-matter content, and is moderately well supplied with plant nutrients. It is characteristically somewhat gravelly, but there is not enough gravel to interfere materially with tillage. Some areas may be gravel-free. The open porous character of this soil permits easy penetration of plant roots and free circulation of air, particularly in the surface and subsurface layers. The soil occupies almost level areas having a gradual slope in the direction of the stream flow. It is subject to overflow during periods of high water. Runoff and internal drainage are slow; the subsoil at depths of 3 feet or more is saturated during most of the winter and early in spring.

Use suitability.—Practically all of this soil has been cleared and cultivated. Much is now in pasture and a portion is reverting to brush and undergrowth.

The soil is suited to rather intensive crop production, but productivity is moderately low and the choice of crops is limited by the imperfect drainage and susceptibility to overflow. Corn and many of the forage crops are well suited; such crops as red clover or the small grain crops are less so. Under continuous cropping fair yields are obtained without amendments; but to increase and maintain yields at a high level, a short rotation that includes a legume and increased fertilization are probably required. For a discussion of use and management, see group 1 in the section on Use and Management of Soils.

Chewacla gravelly fine sandy loam (0–2% slopes) (CB).—This gravelly imperfectly drained soil is restricted to first bottoms along streams flowing from uplands underlain mainly by granite, gneiss, and schist. It differs from Chewacla loam in having enough gravel on the surface and throughout the soil to interfere materially with and, in some places, to prevent cultivation. It is also sandier than Chewacla loam.

This soil occurs in small areas in association with Tusquitee, Congaree, and other Chewacla soils.

Use suitability.—Practically all of this soil has been cleared and cultivated. Much of it is now in pasture, and some is reverting to forest. Only a small part is cultivated, and crop yields are very low. Pastures without amendments give fair yields of fair quality.

Owing to the high content of gravel and imperfect drainage, Chewacla gravelly fine sandy loam is only fairly well suited to crop production. On most farms it is probably best used for pasture. Moderately high yielding pastures of good quality are obtained by the use of lime and phosphate. For a discussion of use and management, see group 1 in the section on Use and Management of Soils.

A, A relatively good crop of wheat on Sequatchie silt loam, undulating phase. The wheat is fall-sown and is used for pasture, winter cover, and grain.

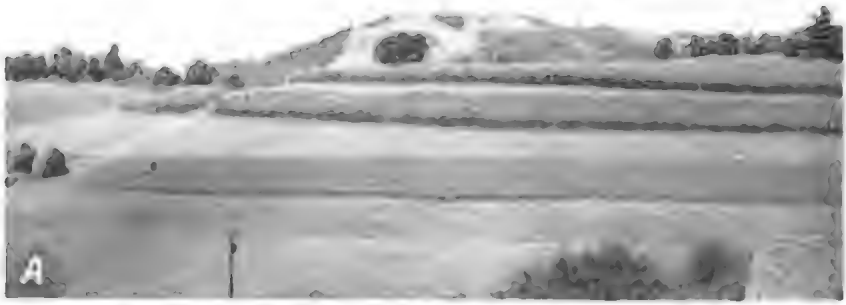
B, Burley tobacco, one of the more important cash crops, is grown in small patches on a large number of farms. Most of the acreage is on Camp, Greendale, Hayter, and Tusquitee soils.

A, Snap beans are grown on the more productive soils, such as Sequatchie, Hayter, and Staser. Transient labor is used to a considerable extent in harvesting the crop.

B, Pasture on Teas or related series. The area on the right has received lime and phosphate.

A, A beef cattle herd (Hereford) on one of the larger farms in the valley section of the county. Rotation pastures furnish a considerable part of the pasturage in this part of the county. Sequatchie soils are in foreground; Ramsey soils in mountainous areas in background.

B, Pasture on Ashe loam, eroded steep phase. Successful pasture production on this soil requires a high level of management. "Cat walks" tend to form in pastures on this soil and disrupt the sod and increase susceptibility to erosion.



A, Stripcropping on Clifton clay loam, eroded hilly phase. The strips in this field consist of corn, clover and grass, snap beans, and alfalfa.
B, A pasture on Dunning silt loam. Drainage and fertilization can be expected to improve the quality and carrying capacity of this pasture.

Clifton clay loam, eroded hilly phase (12–25% slopes) (CD).—This red well drained to excessively drained soil occurs in the mountain areas of the county and was derived from materials weathered chiefly from dark-colored gneiss, schist, and diorite. Its color resembles that of the Hagerstown soils in the limestone valleys. A considerable part of the original surface soil has been lost through erosion. The present surface layer is highly variable in thickness and color. In many small severely eroded spots, all of the surface soil is missing and the red subsoil is exposed. The present surface soil ranges from 0 to 9 inches in depth, and from brown to dark reddish brown in color.

The soil is confined to the Porters-Tusquitee-Clifton soil association. It is closely associated with the Porters, Ashe, Tusquitee, Congaree, and Chewacla soils.

Profile description:

0 to 9 inches, brown to dark reddish-brown friable clay loam with a weak medium crumb structure.
9 to 18 inches, red to reddish-brown friable clay loam with a weak fine to medium blocky structure.
18 to 30 inches, red to reddish-brown friable clay loam or clay with moderate medium blocky structure.
30 to 42 inches +, red to yellowish-red friable clay loam, mottled with light yellowish brown in many places; structure less distinct than that of the layer above.

The entire profile is strongly to very strongly acid, the amount of organic matter apparently moderate, and the content of plant nutrients relatively high. Several angular and flaggy stones, 3 to 6 inches across, are on the surface in many places. This soil is sufficiently friable for moderately rapid penetration of plant roots and for adequate circulation of air and moisture. Moisture is readily absorbed and well retained. This soil is not droughty. Runoff is rapid and internal drainage is medium. The water-supplying capacity is moderately high.

A few small areas are included that have milder slopes than usual. Small areas of associated soils are also included with this soil because boundaries between the Clifton soil and the associated Porters soils are not always distinct. Some of the soils included have lighter colored surface soils and subsoils than described.

Use suitability.—Most of this soil has been cleared of its forest cover and used for crops and pasture.

This soil is suited to the common crops of the county. The loss of soil material by erosion has resulted in the loss of organic matter and plant nutrients, a lowering of the water-supplying capacity, and increased difficulty in maintaining good tilth. However, this is still one of the better upland soils of the mountain area for crop production, although it is somewhat difficult to conserve when used for crops. As this soil has a favorable physical character, excellent response is to be expected from improved management practices, especially adequate fertilization and the proper rotation of crops. It is moderately susceptible to erosion; but if all tillage is on the contour, intertilled crops are followed by cover crops, and if stripcropping is practiced, the soil can be conserved in a rotation of moderate length (pl. 4, *A*). For a discussion of use and management, see group 8 in the section on Use and Management of Soils.

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Cobbly alluvium, Hamblen and Sequatchie soil materials (0–2% slopes) (Ce).—This land type consists of very stony imperfectly drained to well-drained alluvium washed largely from uplands underlain by quartzite, shale, siltstone, conglomerate, and sandstone. It is on bottom lands and low terraces along the smaller streams that head in mountains composed largely of quartzite and sandstone, and most of it is subject to overflow. The bottom lands are most frequently overflowed; the alluvium here is more or less imperfectly drained and comprises the Hamblen soil material. The low terrace areas are less subject to overflow and are made up of more or less well drained alluvium of Sequatchie soil material. This land type occurs in small elongated areas associated with Jefferson, Hayter, Sequatchie, Staser, and Hamblen soils.

Composition of the soil materials of this land type is variable from place to place, and profile characteristics of definite soil series are not present. In the more imperfectly drained areas (Hamblen soil material), the upper 0 to 18 inches of the alluvium is grayish-brown loose very cobbly sandy loam. Below this to about 30 inches is brownish-yellow loose to very friable very cobbly sandy loam. Beneath this material is yellow very cobbly sandy loam, highly mottled with gray and brown. In the better drained areas (Sequatchie soil material) the material is somewhat similar but is browner and has less distinct mottling below 30 inches. The depth of the alluvial deposit ranges from 3 to 15 feet or more.

The soil material is medium to strongly acid in reaction and apparently low in organic matter. In most places the surface is too cobbly for feasible cultivation, and gravel and cobbles constitute a large proportion of the soil mass throughout the depth of the accumulation. The porous friable soil material permits easy penetration of plant roots and affords free movement of air and moisture.

Use suitability.—Practically all areas of Cobbly alluvium, Hamblen and Sequatchie soil materials, have been cleared and cultivated. Because of the very high content of gravel and cobbles, this land type is poorly suited to crops requiring tillage or to semipermanent hay crops. It is probably best used for pasture on most farms, although the yields of pasture can be expected to be low. For a discussion of use and management, see group 9 in the section on Use and Management of Soils.

Congaree fine sandy loam (0–2% slopes) (Cr).—This is a well-drained brown soil of the first bottoms. It consists of general alluvium washed from uplands underlain by granite, gneiss, and schist, together with slight local admixtures of materials washed from uplands underlain by quartzite, shale, siltstone, conglomerate, and sandstone. It is subject to overflow during periods of high water. This soil occurs in narrow elongated areas along the streams. Most of it is along the Watauga River.

Profile description:

0 to 12 inches, dark-brown to brown loose to very friable fine sandy loam.
12 to 24 inches, brown to yellowish-brown friable heavy fine sandy loam.
24 inches +, light yellowish-brown to light-brown loose loamy fine sand.

The soil is slightly to strongly acid and apparently contains a moderate amount of organic matter. It is moderately well supplied with plant nutrients. It is virtually free of gravel and cobbles, al-

though a few areas have a small quantity of gravel and small cobbles scattered over the surface and throughout the profile. The lower layers may contain considerable gravel or cobbles in places. Tillage is not affected by the quantity of gravel and cobbles. The soil is open and porous and allows easy penetration of roots and free circulation of soil air. Rainfall is readily absorbed, and the water-supplying capacity is high. Runoff is slow to medium, and internal drainage is medium to rapid.

As mapped, this soil includes small areas of Congaree loam and of Buncombe loamy fine sand, a yellowish-brown, very friable, excessively drained sandy soil.

Use suitability.—All of this soil has been cleared and cultivated. It is used intensively for truck crops and common field crops.

The soil is well suited to intensive use for crop production. It is especially well suited to truck crops, such as beans and cabbage, and is also well suited to such field crops as corn and most of the hay crops. Periodic overflow somewhat limits the use suitability, but it serves to replenish the supply of organic matter and plant nutrients. This soil is less fertile in general and has a lower water-supplying capacity than the included Congaree loam; consequently, the crop yields average less. For a discussion of use and management, see group 1 in the section on Use and Management of Soils.

Dunning silt loam (0–2% slopes) (Da).—This is a poorly to imperfectly drained dark-colored, almost black, soil on first bottoms. It consists of alluvial materials washed mainly from Ramsey and Hayter soils. These materials are from quartzite, shale, siltstone, conglomerate, and sandstone and are apparently greatly influenced by material from calcareous shale and the underlying limestone. The forest cover consisted mainly of water-tolerant trees. The soil is on nearly level or depressional areas that were swampy, but most of the ponded water is now removed by open ditches. Practically all of this soil is in Shady Valley on the first bottoms along Beaverdam Creek. It is closely associated with Hamblen, Prader, Sequatchie, and Hayter soils.

Profile description:

0 to 6 inches, dark-gray or black mucky silt loam containing partly decayed moss, leaves, twigs, wood, and bark.
6 to 18 inches, dark grayish-brown to black friable silt loam.
18 to 30 inches +, very dark-gray or dark-gray friable silty clay loam faintly mottled with light yellowish brown.

The soil is slightly to medium acid, very high in organic matter, and moderately well supplied with most plant nutrients. Both runoff and internal drainage are very slow. The soil is loose and permeable, but the fluctuating high water table restricts root development and the circulation of air.

This soil varies considerably, especially in depth of surface layer. Some small areas of Prader silt loam are included, mainly because of their small size.

Use suitability.—A considerable part of Dunning silt loam is still in forest. Cleared areas are mainly in pasture, but a small part is in crops. Much of the cleared land has grown up to willow and alder thickets.

In its present condition, this soil is not suitable for the common crops of the county but can be used for pasture in most places. The

pasture is of poor quality and generally includes some rough swamp-grasses (pl. 4, *B*). Use suitability would be broadened by artificial drainage, but would still be limited mainly to summer annual crops such as corn, sorghum, and soybeans. Drainage and fertilization would also greatly improve the quality and quantity of pasturage. For a discussion of use and management, see group 11 in the section on Use and Management of Soils.

Elliber cherty silt loam, hilly phase (12–25% slopes) (ED).—This is a well drained to excessively drained light-colored cherty soil on the valley slopes in the lowland belts. The present materials have weathered from cherty dolomitic limestone. The vegetation consists chiefly of deciduous trees. This soil is chiefly on ridge slopes in the Elliber-Hagerstown-Greendale soil association area. It is closely associated with Hagerstown, Greendale, Teas, Litz, and other Elliber soils.

Profile description:

0 to 6 inches, light brownish-gray to grayish-brown friable cherty silt loam; in wooded areas, a surface layer 1 to 2 inches thick is stained dark with organic matter.
6 to 18 inches, brownish-yellow to reddish-yellow friable cherty silty clay loam.
18 to 34 inches, reddish-yellow to brownish-yellow or light yellowish-brown friable silty clay loam; weak medium blocky structure.
34 to 48 inches +, yellowish-brown to yellowish-red friable silty clay loam coarsely mottled with yellow, gray, and brown; bedrock at depths of 5 to 20 feet or more.

The soil is strongly acid throughout the profile, and the content of organic matter appears to be moderately low except in the thin surface layer. It is only fairly well supplied with plant nutrients. Chert fragments are on the surface and in the plow layer in quantities sufficient to interfere materially with tillage. This soil is permeable enough for penetration of plant roots and normal circulation of soil air and moisture. Water is readily absorbed and is moderately well retained. Runoff is rapid but internal drainage is medium. The water-supplying capacity is moderate.

This soil varies greatly in chert content (some areas are relatively chert-free) and in color, especially of the surface soil. Some areas that have a brown surface soil are included.

Use suitability.—All of this soil has the type of forest cover that follows incomplete timber harvest. It is not very well suited to crops that require tillage, although it can be maintained in a crop rotation under a high level of management. On most farms it is probably best suited to pasture grasses. On many farms the soil cannot be feasibly used for either crops or pasture because of its relatively inaccessible location. Greatly increased pasture yields can be expected from the use of lime and phosphate. For a discussion of use and management, see group 10 in the section on Use and Management of Soils.

Elliber cherty silt loam, eroded hilly phase (12–25% slopes) (EA).—This soil differs from Elliber cherty silt loam, hilly phase, chiefly in being eroded. A considerable part of the original surface soil, including the thin surface layer of higher organic-matter content, has been lost. In many places there has been some mixing of the subsoil with the surface soil in the plow layer. This soil occurs in small widely distributed tracts throughout the area underlain by limestone. It is largely confined to the Elliber-Hagerstown-Greendale soil association.

The present surface layer ranges from light brownish gray to brownish yellow or even reddish yellow. Small severely eroded spots that expose the subsoil are common and conspicuous and have a heavier and less friable surface layer. The subsoil, like that of Elliber cherty silt loam, hilly phase, is a brownish-yellow to reddish-yellow friable silty clay loam.

Use suitability.—All of this soil has been cleared and used for crops and pasture.

Physically it is rather poorly suited to crops requiring tillage. Some causes of its poor suitability for these crops are rather steep slope, relatively low level of natural fertility, chertiness, and moderate water-supplying capacity. Erosion has made it less well suited to crop production than the hilly phase of Elliber cherty silt loam. The loss of a part of the original surface soil has resulted in a loss of organic matter and plant nutrients, an increased susceptibility to erosion, and decreased productivity. The soil is moderately deficient in lime, nitrogen, phosphorus, and potash for most crops. Although susceptible to erosion, it can be maintained under a high level of management. It is better suited physically to permanent pasture than to other uses. Amendments are generally necessary to obtain satisfactory pastures. For a discussion of use and management, see group 10 in the section on Use and Management of Soils.

Elliber cherty silt loam, eroded rolling phase (5–12% slopes) (EB).—This soil differs from Elliber cherty silt loam, eroded hilly phase, chiefly in having a milder slope. A large part of the original surface soil has been lost; in some places the upper part of the subsoil has been brought up by tillage and mixed with the remaining original surface soil. In most places not enough subsoil material has been incorporated into the surface layer to alter materially either the texture or consistence, but it has imparted a brownish-yellow or reddish-yellow color in places. Although a few gullies have formed, they generally are in idle fields where they have not been obliterated by tillage. This soil is widely distributed throughout the Elliber-Hagerstown-Greendale soil association.

The present surface layer is light brownish-gray to brownish-yellow friable cherty silt loam. The subsoil is a brownish-yellow to reddish-yellow friable silty clay loam.

Use suitability.—Practically all of the soil is cleared. Most of it is used for the production of crops common to the area, although some is idle or used for pasture.

Mainly because of chertiness, a moderately low level of fertility, and moderate to low water-supplying capacity, this soil is rather poorly suited to crop production. It is somewhat difficult to work but is responsive to good management, and fair to good yields of all the common crops can be obtained. The response to fertilization is not as lasting as on the Hagerstown soils, however. The soil is fair to good for pasture, but amendments are necessary to obtain high yields. For a discussion on use and management, see group 5 in the section on Use and Management of Soils.

Elliber cherty silt loam, steep phase (25–60% slopes) (EE).—This soil differs from Elliber cherty silt loam, hilly phase, chiefly in having steeper slopes. A few small areas are included that have very steep slopes—greater than 60 percent. This soil is on ridge slopes, mainly in the Elliber-Hagerstown-Greendale soil association area.

Like the hilly phase, this phase has a light brownish-gray to grayish-brown friable cherty silt loam surface soil and a brownish-yellow to reddish-yellow friable silty clay loam subsoil. The soil layers, however, are more variable in thickness and probably are somewhat thinner and less distinct.

Use suitability.—Practically all of this soil is still in woods. The woodland consists chiefly of deciduous trees, dominantly oaks.

Ordinarily this soil is considered too steep for feasible production of field crops over a long period; but other factors contribute to its unfitness for this use, such as chertiness, relatively high susceptibility to erosion, and rather easily depleted virgin fertility. The soil is only moderately well suited to pasture, but with the use of lime and phosphate, reasonably good pastures can be established and maintained. Under present conditions, it is thought to be better suited to forest; and unless there is a definite need for additional pasture, the shifting from forest to pasture is not encouraged. For a discussion of use and management see group 14 in the section on Use and Management of Soils.

Elliber cherty silt loam, eroded steep phase (25–60% slopes) (Ec).—This soil differs from the steep phase of Elliber cherty silt loam chiefly in having lost a large part of the original surface soil. It is widely distributed throughout the Elliber-Hagerstown-Greendale soil association area.

The surface soil consists of a light brownish-gray to brown-cherty silt loam about 3 to 8 inches thick. Where it has been tilled, it has a light reddish-yellow cast owing to the incorporation of the topmost part of the subsoil. The subsoil is brownish-yellow to reddish-yellow friable silty clay loam. A considerable acreage of this soil differs in being relatively chert-free or in having a browner surface soil.

Use suitability.—All of this soil has been cleared for a number of years. Most of it is now used for pasture, but some is used for crop production or is idle. Both crop and pasture yields are relatively low under the prevailing management practices.

The soil is very poorly suited to the production of crops, only moderately suited to permanent pasture, and probably best suited to forest. Owing to the steep slopes, the soil is difficult to till. In addition, it is rather highly susceptible to erosion and moderately low in content of most plant nutrients. It has been demonstrated, however, that fairly good pastures can be established and maintained by proper management, including especially the application of lime and phosphate. The grazing will need to be carefully controlled in order to maintain a good pasture sod. For a discussion on use and management, see group 14 in the section on Use and Management of Soils.

Greendale silt loam (2–7% slopes) (Ga).—This is a well-drained to imperfectly drained soil of the colluvial lands. It was formed from local alluvial or colluvial materials washed mainly from Elliber soils, which are derived mainly from cherty dolomitic limestone. It is on gently sloping areas at the base of slopes from which the soil material has washed. As the material was rather recently deposited, the soil does not have distinct surface soil and subsoil layers. The native vegetation consisted chiefly of deciduous forest. This soil occurs in small irregularly shaped tracts widely distributed in the Elliber-Hagerstown-Greendale soil association area.

Profile description:

0 to 12 inches, light brownish-gray to brown friable silt loam.
12 to 20 inches, yellowish-brown friable silt loam or light silty clay loam.
20 to 32 inches, brownish-yellow friable silt loam or silty clay loam faintly mottled with gray.
32 inches +, brownish-yellow silty clay loam or clay loam mottled with gray; depth of the accumulation ranges from 2 to 10 feet; considerable chert fragments and gravel in most places.

This soil varies somewhat in characteristics from place to place because of differences in parent material, depth of accumulation, texture, and drainage. As mapped, it includes soils in narrow bottom-like areas along the intermittent drainageways and soils on small alluvial-colluvial fans formed from deposits of small streams on the flood plains of larger streams. It also includes some soils that have more distinct surface soil and subsoil layers than described.

Use suitability.—Practically all areas of this soil have been cleared and cultivated and are used intensively for crop production. The soil is well suited to and capable of rather intensive use for crops that require tillage. It has a very low susceptibility to erosion, but control of runoff or erosion cannot be entirely ignored. The soil is moderately fertile and has a high water-supplying capacity; consequently, yields of most crops are relatively high. Lime, phosphate, and nitrogen are somewhat deficient, but yields probably can be maintained for long periods under continuous cropping if the soil is properly fertilized. This soil is fairly well suited to most crops of the county but not so well suited to alfalfa as such soils of the uplands as the Hagerstown. This is one of the better soils of the county for the production of tobacco. For a discussion of use and management, see group 2 in the section on Use and Management of Soils.

Hagerstown silty clay loam, eroded rolling phase (5–12% slopes) (HB).—This is the well-drained red or reddish-brown soil in the lowland-belt valleys. The material from which the soil is derived has weathered from dolomitic limestone. A considerable part of the original surface soil has been lost as a result of erosion. The present surface layer is therefore highly variable, ranging from 0 to 10 inches in depth and from brown to reddish brown in color. In many small spots, all the surface soil is missing and the reddish-brown subsoil is exposed. On most places a part of the subsoil has been mixed with the remnants of the original surface soil during tillage. The result is a heavier less friable surface layer.

The soil is closely associated with the Elliber soils, and like those soils it is underlain by limestone material. It differs in being from purer dolomitic limestone, and in being browner and relatively free of chert. The native vegetation was mainly deciduous forest. The soil is chiefly on the lower valley slopes in the Elliber-Hagerstown-Greendale soil association area.

Profile description:

0 to 8 inches, dark-brown to dark reddish-brown friable silt loam to reddish-brown friable silty clay loam.
8 to 18 inches, reddish-brown friable to firm silty clay; moderate medium blocky structure.
18 to 40 inches, red to reddish-brown firm silty clay that has a strong medium blocky structure; a few small dark concretions.
40 inches +, reddish-brown to yellowish-red firm or very firm silty clay with small pale-brown mottles; a few fragments of chert and limestone and some small concretions.

The soil is medium to strongly acid, apparently moderately well supplied with organic matter, and relatively high in plant nutrients. It is relatively stone-free, but some angular chert is on the surface in places. It is moderately permeable to air, roots, and water. Moisture is readily absorbed and well retained. The water-supplying capacity is moderate. Both runoff and internal drainage are medium.

Use suitability.—This soil has been cleared and used for crops and pasture. Only a very few acres are still in woods, and these are in small tracts not readily accessible.

The soil is well suited to the common crops of the county and is especially well suited to alfalfa and other deep-rooted legumes if properly fertilized. The loss of soil material through erosion has resulted in the loss of organic matter and plant nutrients, a lowering of water-supplying capacity, and increased difficulty in maintaining good tilth. The soil has favorable physical characteristics and responds well to good management. Although moderately susceptible to erosion, it can be conserved in a rotation of moderate length if all tillage is on the contour and cover crops follow all intertilled crops. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Hagerstown silty clay loam, eroded hilly phase (12–25% slopes) (HA).—This soil differs from Hagerstown silty clay loam, eroded rolling phase, chiefly in having a steeper slope, but it is generally more eroded. It is largely confined to the Elliber-Hagerstown-Greendale soil association. Elliber, Teas, Camp, Greendale, and other Hagerstown soils are closely associated.

In most places some of the subsoil has been mixed with the remainder of the original surface soil, so the resulting surface layer is a brown or reddish-brown friable silty clay loam. The subsoil, similar to that of the other Hagerstown soils, is red to reddish-brown firm silty clay.

Use suitability.—Practically all of this soil has been cleared for a number of years and used for crops and pasture. Only a small part is lying idle, and a very small acreage is in woods. Normally the crop yields are lower than on Hagerstown silty clay loam, eroded rolling phase.

Chiefly because of the stronger slope, this soil is not as well suited to crop production as the eroded rolling phase. Management of this eroded hilly phase is considerably more exacting. Longer rotations and less frequent use of row crops are required; in fact, in many areas it may be preferable to avoid using row crops altogether. The soil is very well suited to pasture or semipermanent hay crops, particularly deep-rooted legumes such as alfalfa. Since good tilth is somewhat difficult to maintain, this soil cannot be tilled over so wide a range of moisture conditions as soils such as Sequatchie and Hayter. Contour tillage and contour stripcropping will permit more intensive use without injury. Although the soil is moderately well supplied with organic matter and plant nutrients, the use of amendments will be necessary for continued high yields of all crops and essential for success with crops such as red clover and alfalfa. For a discussion of use and management, see group 8 in the section on Use and Management of Soils.

Hagerstown silty clay loam, eroded steep phase (25–60% slopes) (HC).—This soil has a steeper slope than the eroded hilly phase. Like that soil, it is derived from materials weathered from dolomitic lime-

stone and has lost a considerable part of the surface soil as a result of erosion. This soil is in close association with Elliber, Teas, Litz, Greendale, and other Hagerstown soils. It is largely confined to the Elliber-Hagerstown-Greendale soil association.

The present surface layer is a brown to reddish-brown friable silty clay loam. The subsoil, like that of other Hagerstown soils, is a red to reddish-brown firm silty clay. The depth to bedrock is less than for the less steep Hagerstown soils.

Use suitability.—About 15 percent of this soil is in cutover forest. Most of the rest is in hay or pasture, but 20 to 30 percent is idle.

Ordinarily this soil is considered too steep and too susceptible to erosion for the feasible production of field crops over an extended period. It is better suited to permanent pastures, and indications are that excellent pastures can be obtained with the proper use of amendments. Grazing will need to be carefully controlled, however, in order to maintain a sod that will prevent excessive loss of soil material through erosion. For a discussion of use and management, see group 13 in the section on Use and Management of Soils.

Hamblen loam (0–2% slopes) (Hd).—This is an imperfectly drained loamy soil that occurs on nearly level flood plains subject to overflow. It consists of mixed alluvium washed from uplands underlain by quartzite, shale, siltstone, conglomerate, and sandstone, but includes some material from dolomite in places. Hamblen loam is intermediate in drainage between the well-drained Staser and the poorly drained Prader soils, and the differences in these soils result mainly from differences in drainage. It occupies narrow elongated areas along streams in all except the mountainous eastern section of the county. The soil is closely associated with Hayter, Sequatchie, Jefferson, Staser, Prader, and Ramsey soils.

Profile description:

0 to 14 inches, brown to grayish-brown loose to very friable loam.
14 to 32 inches, brown to light yellowish-brown friable or very friable loam mottled with gray, yellow, and brown.
32 inches +, friable loam to loamy fine sand highly mottled with reddish brown, yellow, and gray; in many places contains gravel and cobbles 2 to 4 inches in cross-section.

The soil is medium acid and moderately well supplied with organic matter and plant nutrients. Some areas included are strongly acid and others are nearly neutral. Some gravel and cobbles are on the surface and throughout the soil in many places, but not in quantities sufficient to interfere materially with tillage. The soil is very permeable and permits easy penetration of plant roots and good circulation of air and moisture when not saturated. The water-supplying capacity is very high. Both runoff and internal drainage are slow.

Use suitability.—Practically all of this soil is cleared and used, chiefly for corn and hay crops. Some is used for rotation pasture, and a small but important acreage is used for vegetable crops. Crop yields are variable, but in general they are higher than on the adjacent upland soils.

Because of imperfect drainage and susceptibility to flooding, this soil is limited mainly to summer crops. It is well suited to corn and hay crops that are moderately tolerant of wet conditions, and very well suited to many of the vegetable crops. It is not well suited to

alfalfa or small grains. The soil is especially valuable for pasture because it remains productive through extended dry periods when the pastures on the uplands are short. Artificial drainage can be expected to broaden the use suitability of this soil to some extent. Lime is not ordinarily needed for the adapted crops; phosphorus and nitrogen are most likely to be needed. For a discussion of use and management, see group 1 in the section on Use and Management of Soils.

Hayter loam, undulating phase (2–5% slopes) (Hk).—This is a brown well-drained soil of the colluvial lands. It has formed from colluvium and local alluvium washed from uplands underlain largely by quartzite, shale, siltstone, conglomerate, and sandstone. This material has been influenced by water or mixed with material from limestone or other calcareous rocks. The parent material is chiefly from Ramsey soils, but in some places includes materials from Teas or Litz soils. Some of the areas are below or adjacent to outcroppings of limestone and are very likely influenced by lime-bearing water. However, in other areas of the soil the calcareous material comes from calcite veins or bands in the quartzite or from calcareous shale. Hayter loam, undulating phase, occurs in small areas closely associated with areas of Ramsey, Matney, Teas, Sequatchie, and Jefferson soils. Most of the areas are either in the Hayter-Sequatchie or Jefferson-Hayter soil association areas.

Profile description:

0 to 12 inches, brown or dark-brown very friable loam of medium crumb structure; in wooded areas the surface 2 or 3 inches is stained dark grayish brown with organic matter.

12 to 30 inches, yellowish-brown to strong-brown friable clay loam of a weak medium blocky structure.

30 inches +, yellowish-brown to light yellowish-brown friable clay loam mottled with yellow and gray in most places; depth of colluvial deposit ranges from 3 to 10 feet or more.

This soil is medium to strongly acid in reaction, high in plant nutrients, and apparently well supplied with organic matter. Some areas have a few small cobbles on the surface and throughout the soil that do not interfere materially with tillage. The lower soil layers are cobbly in many places (pl. 5, *A*). The soil is permeable and permits easy penetration of roots and circulation of air and moisture. Water is readily absorbed and the water-supplying capacity is high.

Hayter loam, undulating phase, as mapped, includes small areas of Shouns silt loam and Sequatchie silt loam as well as other Hayter soils. It also includes several areas that have less distinct surface soil and subsoil layers. These areas are chiefly along narrow drainageways or at the base of eroding slopes where they receive frequent additions of fresh sediments. Some areas of soil, similar to the Emory soil in adjacent counties, that have formed chiefly from limestone materials are also included because of their small acreage. The Emory soil has a friable light-brown to dark-brown silt loam or loam surface soil about 12 to 20 inches thick that contains considerable well-incorporated organic matter. The subsoil, usually a yellowish-brown friable silty clay loam about 8 to 20 inches thick, is underlain by friable colluvial or local alluvial material of finely mingled colors.

Use suitability.—Practically all areas of Hayter loam, undulating phase, have been cleared and cultivated and are used intensively for

crop production. Only a very small part is idle or in nonfarm uses. Systematic crop rotations are not customary, but some farmers use a 3-year rotation of corn, small grains, and hay.

This soil is well suited to practically all crops, including tobacco, alfalfa, and truck crops, and to pasture. The soil is naturally relatively fertile, but crops respond well to fertilizer and lime. If tilth and moisture relations are favorable, large yields can be consistently produced where the supply of plant nutrients, lime, and organic matter is maintained at a high level. The soil is somewhat deficient in lime, phosphate, nitrogen, and potash for continued high yields of most crops. Although slightly susceptible to erosion in most places, the soil can be maintained in a crop rotation of short or moderate length if contour farming is practiced. For a discussion of use and management, see group 2 in the section on Use and Management of Soils.

Hayter loam, eroded rolling phase (5–12% slopes) (HF).—This is a brown well-drained soil of the colluvial lands formed from materials washed chiefly from Ramsey soils. It differs from Hayter loam, undulating phase, in having a stronger slope and in being eroded. A considerable part of the original surface layer has been lost through erosion, and subsequent tillage has incorporated the remaining part with the upper subsoil. Erosion losses have been uneven, however, and in many spots the plow layer is entirely within the original surface layer. The few severely eroded areas included are conspicuous because of exposures of the subsoil. Most of this soil is in the Hayter-Sequatchie soil association, but small acreages are in the Jefferson-Hayter.

The present surface layer ranges from loam to clay loam in texture and from dark brown or brown to yellowish-brown in color. The subsoil is a yellowish-brown to strong-brown friable clay loam.

Use suitability.—All of this soil is cleared and most of it is being used for crops and pasture. It is well suited to the production of a wide variety of crops, including truck crops, alfalfa, red clover, and tobacco. Additions of lime and fertilizers are necessary to grow some crops successfully and to maintain or increase the yields of most crops. Potash may be limiting for many crops, especially the deep-rooted legumes. The soil is moderately susceptible to erosion. A crop rotation of moderate length that includes grasses and legumes is desirable not only for protection against erosion, but also for its beneficial effect on content of organic matter and nitrogen and on tilth conditions. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Hayter loam, hilly phase (12–25% slopes) (HG).—This is a brown well-drained soil in colluvial positions at the base of rather long, steep upland slopes. It differs from the undulating phase chiefly in having much steeper slopes. As a result of its steeper slopes, it is slightly lighter in color, somewhat lower in organic matter and plant nutrients, slightly thinner, and more susceptible to erosion. Hayter loam, hilly phase, is closely associated with Ramsey, Sequatchie, Jefferson, Staser, and Hamblen soils. Most of it is in the Hayter-Sequatchie and Jefferson-Hayter soil association areas. It has a brown or dark-brown friable loam surface soil and a yellowish-brown or strong-brown friable clay loam subsoil.

Use suitability.—Most of this soil is in forest but a small part has been cleared and cultivated. The soil is suited to practically all crops, including tobacco, red clover, alfalfa, and truck crops. It is productive and fairly easy to work, but it is moderately difficult to conserve because of losses by erosion. This phase is inferior to the undulating phase chiefly because of the stronger slope and greater susceptibility to erosion. Crop rotations must be longer and consist mainly of close-growing crops, or stripcropping will be necessary. Although good yields ordinarily can be obtained without amendments, some fertilization and liming are needed to maintain high yields. The soil is moderately deficient in lime, phosphorus, nitrogen, and possibly potassium for continuous high yields of most crops. Unless a fairly high level of management is followed, the soil is probably best used for pasture or semipermanent hay crops. For a discussion of use and management, see group 6 in the section on Use and Management of Soils.

Hayter loam, eroded hilly phase (12–25% slopes) (He).—This is a brown well-drained soil formed from materials washed or rolled chiefly from Ramsey soils. It differs from Hayter loam, eroded rolling phase, chiefly in having a steeper slope. As on that soil, a considerable part of the original surface layer has been lost through erosion, and tillage operations have mixed the remaining part with the upper part of the subsoil. The surface layer has not been uniformly removed, and in places the plow layer is entirely within the original surface layer. The severely eroded areas included are conspicuous because of subsoil exposure and numerous shallow gullies. The soil occurs in small tracts closely associated with areas of Ramsey, Staser, Hamblen, Sequatchie, and Jefferson soils. Most of the acreage is in the Hayter-Sequatchie and Jefferson-Hayter soil association areas.

The present surface layer ranges from loam to clay loam in texture and from dark brown or brown to yellowish brown in color. The subsoil is a yellowish-brown to strong-brown friable clay loam.

Use suitability.—Most of this soil is cleared and is being used for crops and pasture. Some of the more severely eroded areas are abandoned and are reverting to forest.

Chiefly because of its stronger slopes, this soil is not so well suited to crop production as Hayter loam, eroded rolling phase. It is moderately productive of a wide variety of crops, but productivity of row crops is difficult to maintain because of erosion losses. A longer rotation is needed than for the eroded rolling phase, and it should consist chiefly of close-growing crops. On many farms, Hayter loam, eroded hilly phase, is probably best used for semipermanent hay crops or pasture. Applications of lime and phosphate will be needed to establish and maintain highly productive pastures. Contour tillage and contour stripcropping will make more intensive use of the soil possible. For a discussion of use and management, see group 6 in the section on Use and Management of Soils.

Hayter stony loam, undulating phase (2–5% slopes) (Hs).—This soil differs from Hayter stony loam, rolling phase, chiefly in having a milder slope. In most places it has a deeper colluvial deposit, thicker soil layers, and less loss of surface soil through erosion than the rolling phase; but both soils have enough stones to interfere materially with cultivation (pl. 5, *B*). It differs from Hayter loam, un-

dulating phase, chiefly in being stony. Hayter stony loam, undulating phase, is in all the valleys and is closely associated with Jefferson, Sequatchie, Teas, Ramsey, and Staser soils.

The surface soil is a brown or dark-brown very friable stony loam, and the subsoil is a yellowish-brown or strong-brown friable stony clay loam.

Use suitability.—Practically all of this soil is cleared and used for crops and pasture. It is used in short irregular rotations, and row crops are grown at frequent intervals.

This soil is well suited to intensive crop production, but because of stoniness it is not as desirable as Hayter loam, undulating phase. It is relatively fertile and has a moderately high water-supplying capacity. It is suited to the production of practically all crops of the county, particularly tobacco and vegetables. Lime and phosphate are generally required for the successful growth of deep-rooted legumes, such as red clover and alfalfa. The soil is slightly deficient in lime, phosphate, nitrogen, and possibly potash for maximum production of many crops. Conservation of soil material and fertility is not difficult. For a discussion of use and management, see group 4 in the section on Use and Management of Soils.

Hayter stony loam, rolling phase (5–12% slopes) (Hp).—This is a well-drained brown stony soil formed from colluvium and local alluvium. The parent material consists of materials washed chiefly from Ramsey and Matney soils. This soil differs from Hayter loam, eroded rolling phase, chiefly in not being eroded and in having more stones on the surface and throughout the soil mass. Hayter stony loam, rolling phase, is in small elongated areas closely associated with Ramsey, Matney, Jefferson, Staser, and Hamblen soils. Most of the acreage is in the Hayter-Sequatchie and Jefferson-Hayter soil association areas.

Profile description:

0 to 12 inches, dark-brown or brown very friable stony loam.
12 to 24 inches, yellowish-brown to strong-brown friable stony clay loam.
24 inches +, yellowish-brown to light yellowish-brown friable stony clay loam or sandy clay loam.

This soil is medium acid and apparently well supplied with organic matter. It is relatively high in content of most plant nutrients. Small angular and subangular sandstone fragments and cobbles are scattered over the surface and throughout the soil. The soil is very permeable and permits easy penetration of roots and normal circulation of air and moisture. Water is readily absorbed and well retained. The water-supplying capacity is moderately high. Runoff is medium and internal drainage is rapid.

Use suitability.—Practically all of this soil is in forest; only a small part has been cleared (pl. 6, *A*) and used for crops and pasture. A small acreage of the cleared soil is idle each year.

This is a relatively fertile soil suitable for crops and pasture. It is less desirable than Hayter loam, eroded rolling phase, however, because stones materially interfere with tillage and clipping of pastures. The soil is only slightly susceptible to erosion. If the fertility is maintained and lime added, the more exacting small-grain, hay, and pasture crops are suited. Chiefly because of its favorable moisture relations, this soil maintains pasture vegetation during dry periods better than

the associated soils of the uplands. For a discussion of use and management, see group 4 in the section on Use and Management of Soils.

Hayter stony loam, eroded rolling phase (5–12% slopes) (Hm).—This is a brown well-drained soil of the colluvial lands. It differs from Hayter stony loam, rolling phase, chiefly in being eroded. A considerable part of the original surface soil has been lost, and the remnants have been mixed with the subsoil in most places. The loss of soil material has been uneven over the areas, and the depth of the present surface layer is consequently variable. This is a fairly extensive soil, widely distributed in practically all the valleys within the county. It is closely associated with Ramsey, Matney, Staser, Hamblen, Sequatchie, and other Hayter soils.

The surface layer is a dark-brown, brown, or yellowish-brown friable stony loam, or a clay loam in some places. The subsoil consists of yellowish-brown or strong-brown friable stony clay loam.

Use suitability.—Practically all of this soil has been cleared and used for crops and pasture. Only a small part is idle or in nonfarm uses.

This relatively fertile soil is well suited to crops and pasture. Stoniness interferes with tillage and pasture clipping, and makes the soil less desirable for crop production than Hayter loam, eroded rolling phase. As a result of erosion and cropping, the content of organic matter and plant nutrients and the water-supplying capacity have been reduced. In addition, the soil is more susceptible to further erosion. If properly limed and fertilized, this soil is well suited to all the common crops of the county. Removal of the larger stones greatly increases workability but has not proved practical except for very small areas or for high-yielding cash crops such as tobacco and vegetables. For a discussion of use and management, see group 4 in the section on Use and Management of Soils.

Hayter stony loam, hilly phase (12–25% slopes) (Ho).—This brown well-drained stony soil of the colluvial lands was formed from materials washed or rolled from Ramsey and Matney soils of the uplands. It differs from Hayter stony loam, rolling phase, mainly in having steeper slopes. This hilly phase is on moderately steep colluvial foot slopes, chiefly on the outer edge of the principal valleys adjacent to the steep or very steep mountain slopes. It is closely associated with Ramsey, Matney, and other Hayter soils.

Profile description:

0 to 10 inches, dark-brown or brown very friable stony loam.
10 to 22 inches, yellowish-brown to strong-brown friable stony clay loam.
22 inches +, yellowish-brown to light yellowish-brown friable stony clay loam or sandy clay loam; extremely stony in many places.

This is a medium acid relatively fertile soil well supplied with organic matter and moderately well supplied with all the major plant nutrients. Angular and subangular sandstone and quartzite fragments and cobbles are scattered over the surface and throughout the soil. Commonly they are 2 to 6 inches across. The soil is very permeable. Air, roots, and moisture penetrate easily. Water infiltrates rapidly and is moderately well retained. Runoff and internal drainage are rapid.

Use suitability.—Practically all of this soil is in forest consisting of white pine and a variety of hardwoods. It is relatively fertile and productive of most of the crops commonly grown in the county. Be-

cause of its stronger slopes, however, it is less desirable for crop production than Hayter stony loam, rolling phase. It is only fairly well suited to crops that require tillage but is well suited to pasture and close-growing crops. Hilly slopes and stoniness make the soil somewhat difficult to work. Soil conservation is also somewhat difficult; a long rotation consisting mainly of close-growing crops combined with contour tillage is generally needed. More intensive use is possible if stripcropping is practiced. For a discussion of use and management, see group 9 in the section on Use and Management of Soils.

Hayter stony loam, eroded hilly phase (12–25% slopes) (HL).—This is a brown stony soil of the colluvial lands formed from materials washed or rolled mainly from Ramsey and Matney soils. It differs from Hayter stony loam, hilly phase, chiefly in being eroded. A considerable part of the original surface layer has been lost through erosion. In many places the remnants of the surface layer have been mixed with the subsoil in the plow layer. Over most of the areas, however, the plow layer is within the original surface soil. This is the most extensive of the Hayter soils and is widely distributed.

The present surface layer is dark-brown, brown, or even yellowish-brown friable stony loam. It is a clay loam in the more eroded areas. The subsoil consists of yellowish-brown or strong-brown friable stony clay loam.

Use suitability.—Practically all of this soil is cleared and used for crops and pasture. A part is idle and some is reverting to forest.

This soil is well suited to pasture and close-growing crops. It is stony and moderately steep, and the difficulty of working and conserving the soil lowers its suitability for intertilled crops. Fair yields of practically all the common crops are obtained without amendments, but the use of amendments is required to increase and maintain yields. A long rotation consisting mainly of close-growing crops is generally necessary to prevent excessive soil loss from erosion. The soil is probably best used for semipermanent hay or pasture crops on most farms. Contour stripcropping makes possible more intensive use of this soil. For a discussion of use and management, see group 9 in the section on Use and Management of Soils.

Hayter stony loam, steep phase (25–60% slopes) (HR).—This is a stony well-drained soil on steep colluvial foot slopes. It has formed from materials washed or rolled mainly from Ramsey and Matney soils. The soil differs from Hayter stony loam, hilly phase, chiefly in having steeper slopes. Surface soil and subsoil layers are less distinct, and their thickness averages less. In most places the soil is more stony and the stones are larger. This soil is widely distributed in Shady Valley as well as in the valleys of Laurel and Roan Creeks. It is much less extensive in the valley of Doe Creek. Ramsey, Matney, and other Hayter soils are closely associated.

The surface layer is a brown very friable stony loam. The subsoil is a yellowish-brown to strong-brown friable stony clay loam or heavy loam.

Use suitability.—All of this soil is in forest consisting mainly of white pine and various hardwoods. Owing to the steep slopes and stoniness, the soil is very difficult to work and difficult to conserve when cleared and used for crops. It is generally considered unsuitable for crops that require tillage, but it is fairly well suited to pasture. It

will produce good pastures, especially if properly fertilized, but weeds are very difficult to control. The steep slopes and large stones almost prohibit the use of mowing machines for clipping the pastures. On a great many of the farms, this soil is probably best left in forest. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Hayter stony loam, eroded steep phase (25–60% slopes) (HN).—This is a stony well-drained soil on steep colluvial foot slopes. The soil is generally at the base of very steep mountain slopes, and the parent materials have washed or rolled mainly from Ramsey and Matney soils. It differs from Hayter stony loam, steep phase, chiefly in being eroded. A considerable part of the original surface layer, including the thin surface layer of high organic-matter content, has been lost as a result of erosion. This is one of the most extensive of the Hayter soils. It is widely distributed in Shady Valley as well as in the valleys of Laurel and Roan Creeks. Some areas are also in the valley of Doe Creek.

The present surface layer is highly variable in thickness and color; it is a brown to yellowish-brown friable stony loam. The subsoil is yellowish-brown to strong-brown friable stony clay loam. Erosion has removed much of the finer material and left an accumulation of stones on the surface.

Use suitability.—All of this soil is cleared and used for crops and pasture. A considerable part is idle at present, and some is reverting to forest.

Owing to the steep slopes and stoniness, the soil is very poorly suited to crops that require tillage; it is fairly well suited to pasture. It is very difficult to work and difficult to conserve, although moderately productive. Good pastures can be established and maintained if properly fertilized. Weed control is difficult, and an occasional intertilled crop may need to be grown to eliminate excessive weeds. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Jefferson loam, eroded rolling phase (5–12% slopes) (JA).—This is a yellow, sandy, well-drained soil of the colluvial lands. The colluvial or local alluvial materials from which the soil has formed were derived from uplands underlain by quartzite, shale, siltstone, conglomerate, and sandstone. The materials washed or rolled largely from Ramsey soils of the uplands. The soil is on gently sloping to sloping areas at the base of the upland slopes from which the materials were derived and in most places spreads out a considerable distance over the valley floor.

Most areas of this soil are moderately eroded, and a notable part of the original surface soil has been lost. The surface soil has mixed with the subsoil in places and is highly variable in thickness, color, and texture. Some areas have lost most of the original surface layer through severe erosion and are conspicuous because of subsoil exposure. Shallow gullies are common in these areas. Jefferson loam, eroded rolling phase, occurs in small irregularly shaped areas in most of the valleys and is closely associated with Hayter, Sequatchie, Ramsey, Staser, Hamblen, Matney, and other Jefferson soils.

Profile description:

0 to 8 inches, grayish-brown or light brownish-gray very friable loam; in wooded areas there is a thin surface layer stained dark with organic matter.

8 to 30 inches, yellowish-brown to brownish-yellow or light yellowish-brown friable clay loam.

30 inches +, brownish-yellow to reddish-yellow friable sandy clay to fine sandy loam, mottled with gray, brown, and yellow; the depth of the accumulation ranges from about 4 to 20 feet.

The soil is strongly acid and low in organic matter and plant nutrients. The few stones on the surface and throughout the soil mass do not interfere substantially with cultivation. The soil is permeable and permits easy penetration of roots and good circulation of air and moisture. Runoff and internal drainage are medium.

A few small areas of uneroded soil are included. A few very small stony areas are also included, as well as a small acreage having slopes of 2 to 5 percent.

Use suitability.—Most of this soil has been cleared and placed under cultivation, but an estimated 10 to 20 percent is currently idle or in nonfarm uses. A variety of crops are grown in very irregular rotation.

This soil is moderately well suited to the production of crops and pasture. Owing to the naturally low fertility and moderately low water-supplying capacity, the yields of most crops are low. Lime, phosphate, nitrogen, and potash are deficient in this soil for most crops and highly deficient for some. However, response to the application of these fertilizing elements is good. The soil is not highly susceptible to erosion and can be maintained under a moderately short rotation if properly fertilized and tilled on the contour. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Jefferson stony fine sandy loam, rolling phase (5–12% slopes) (JE).—This is a light-colored stony well-drained soil of the colluvial lands. It is at the base of steep mountain slopes or spread out a short distance over the valley floor. The soil has formed from materials washed or rolled from uplands underlain by quartzite, shale, siltstone, conglomerate, and sandstone and occupied mostly by Ramsey soils. The soil is in relatively small areas, largely in the Jefferson-Hayter and Ramsey-Jefferson soil associations, and is closely associated with Ramsey, Hayter, and other Jefferson soils.

Profile description:

0 to 8 inches, grayish-brown or light brownish-gray very friable stony fine sandy loam; a thin surface layer 1 to 2 inches thick and stained dark with organic matter occurs in most places.

8 to 30 inches, yellowish-brown to brownish-yellow or light yellowish-brown friable stony sandy clay loam or clay loam.

30 inches +, brownish-yellow to yellowish-red friable stony sandy clay loam mottled with gray, red, and brown in most places; the depth of the colluvial deposit ranges from 3 to 15 feet or more.

This soil is strongly acid and apparently low in organic matter and plant nutrients. Few to numerous rounded and angular stones, 5 to 10 inches across, are on the surface and throughout the soil in sufficient quantity to interfere materially with cultivation. The soil is very permeable to air, roots, and water. The moisture-supplying capacity is moderately low.

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Use suitability.—All of this soil has a forest cover at the present time. It is suited to crops and pasture, but low fertility and stoniness limit its usefulness. Also, on many farms it occurs in small and not readily accessible tracts. Since it is deficient in most of the essential plant nutrients and in water-supplying capacity, it can be expected to be low in productivity for pasture and most crops. Most of the common crops of the area can be grown, but crops such as tobacco, red clover, and alfalfa would require heavy fertilization for successful growth. Complete fertilizer is generally needed to increase and maintain the yield of most crops at a satisfactory level. For a discussion of use and management, see group 5 in the section on Use and Management of Soils.

Jefferson stony fine sandy loam, eroded rolling phase (5–12% slopes) (JB).—This soil is on rolling areas of alluvial-colluvial material below and adjacent to hilly and steep Ramsey soils. It differs from Jefferson stony fine sandy loam, rolling phase, chiefly in having lost a considerable part of the surface soil as a result of erosion. The original surface layer still constitutes the plow layer over most of the area, but there has been some mixing with the subsoil in small spots. This phase is closely associated with Ramsey, Hayter, and other Jefferson soils.

The present surface layer of this soil is a grayish-brown to light yellowish-brown stony fine sandy loam. The subsoil is a brownish-yellow friable stony fine sandy clay loam.

Use suitability.—All areas of Jefferson stony fine sandy loam, eroded rolling phase, have been cleared and used for crops or pasture. A considerable area is idle, and some of it is reverting to forest. A number of crops are grown in very irregular rotation.

The soil is moderately well suited to crops and pasture, but it is not naturally productive of either. Low fertility, low water-supplying capacity, stoniness, and slope greatly limit its usefulness. It is deficient in the major plant nutrients for practically all crops. Fertilization is necessary for good yields of most crops, and heavy applications of lime and fertilizers are required to maintain stands of such crops as alfalfa and red clover. Since the soil is moderately susceptible to erosion, special effort is required to control water on the land. For a discussion of use and management, see group 5 in the section on Use and Management of Soils.

Jefferson stony fine sandy loam, hilly phase (12–25% slopes) (JD).—This is a light-colored stony well-drained soil of the colluvial lands. It has formed at the base of mountain slopes from materials washed or rolled chiefly from Ramsey soils. It differs from Jefferson stony fine sandy loam, rolling phase, chiefly in having steeper slopes. It is somewhat more variable in characteristics than that soil, especially in stoniness and depth to underlying material. It occurs in small irregularly shaped areas in most of the valleys. The Ramsey and Hayter are closely associated soils.

Profile description:

0 to 8 inches, grayish-brown very friable stony fine sandy loam.
8 to 28 inches, yellowish-brown to brownish-yellow or light yellowish-brown friable stony sandy clay loam or clay loam.
28 inches +, brownish-yellow to yellowish-red friable stony sandy clay loam, mottled with gray, yellow, red, and brown; depth of the colluvial deposit ranges from 3 to 15 feet or more.

This soil is strongly acid. It absorbs moisture readily but is too porous to retain it well. The content of organic matter and plant nutrients is low. Numerous rounded and angular stone fragments 2 to 10 inches across are on the surface and throughout the soil mass. A few large stones more than 10 inches across are on the surface. The soil is sufficiently permeable for easy root penetration and for air and moisture circulation.

Use suitability.—About two-thirds of this soil is in forest. Most of the cleared part is used for growing a wide variety of crops and pasture, but a considerable part is idle.

The soil is not generally considered suitable for crops and is poorly suited to pasture. Owing to the low fertility and low water-supplying capacity, it is low in productivity for both crop and pasture plants. Tillage, pasture clipping, and weed control are difficult because of stoniness and strong slopes. It is considered a good practice to grow a clean-cultivated crop at long intervals for weed control. Applications of lime and phosphate are generally required to establish and maintain good pastures. On many farms, the soil is best used for forest. For a discussion of use and management, see group 9 in the section on Use and Management of Soils.

Jefferson stony fine sandy loam, steep phase (25–60% slopes) (JF).—This is a steep, stony, well drained to excessively drained soil of the colluvial lands. It is at the base of steep or very steep mountain slopes and has formed from materials rolled and washed from Ramsey soils of the uplands. It differs from Jefferson stony fine sandy loam, hilly phase, chiefly in having stronger slopes. In addition, it generally has a shallower colluvial deposit and less distinct and thinner soil layers. Large stones are also more common. Jefferson stony fine sandy loam, steep phase, is closely associated with Ramsey, Hayter, and other Jefferson soils on the foot slopes of Iron, Doe, Little Dry Run, and Dry Run Mountains.

This soil has a grayish-brown friable stony fine sandy loam surface soil and a yellowish-brown to brownish-yellow stony friable sandy clay loam or heavy fine sandy loam subsoil.

Use suitability.—Practically all of this soil is in forest. On most farms, it is probably best used for forest. Its steep slopes, low fertility, water-supplying capacity, and stoniness make it very poorly suited to crops or pasture. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Jefferson stony fine sandy loam, eroded steep phase (25–60% slopes) (JC).—This is a steep, stony, well drained to excessively drained soil of the colluvial lands. It has formed at the base of steep mountain slopes from materials washed or rolled from Ramsey and associated soils of the uplands. It differs from Jefferson stony fine sandy loam, hilly phase, in being moderately eroded and in having steeper slopes. In most places the colluvial deposit is shallower and the soil layers are thinner and less distinct. Large stones more than 10 inches across are also more common. An estimated 25 to 60 percent of the original surface soil has been lost through erosion, and some areas are included that have lost practically all of it. The soil is closely associated with Ramsey, Hayter, and other Jefferson soils on the foot slopes of Iron, Doe, and Dry Run Mountains.

The present surface layer is a grayish-brown to light yellowish-brown friable fine sandy loam. The subsoil consists of yellowish-brown to brownish-yellow friable stony fine sandy loam to sandy clay loam.

Use suitability.—All of this soil has been cleared and much has been cultivated. Most of it is now in pasture or in idle land that is reverting to forest.

This soil is very difficult to work and conserve and is of very low productivity for most hay and pasture plants. It is low in fertility, low in water-supplying capacity, stony to very stony, and very susceptible to further loss from erosion. Consequently, it is generally not considered suitable for either crops or pasture and is best used for forest. On many farms, however, it may be necessary to use the soil for pasture. Under a high level of management that includes adequate applications of lime and phosphate, available evidence indicates that fair pastures can be established and maintained. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Jefferson stony loam, rolling phase (5–12% slopes) (JM).—This is a well-drained stony soil formed at the base of upland slopes. The parent material rolled or washed from these slopes is largely from Ramsey soils but includes a small admixture from Teas and Litz soils in most places. The soil is underlain by calcareous shale or limestone at depths of 5 to 20 feet in many places, but the usual depth to bedrock is 3 to 15 feet. This soil differs from Jefferson stony fine sandy loam, rolling phase, mainly in being finer textured, although it is also somewhat browner. It is closely associated with Hayter, Ramsey, Sequatchie, Teas, Litz, and other Jefferson soils. The larger part of the soil is in the valley of Doe Creek, but other areas are in the valleys of Laurel and Roan Creeks.

Profile description:

0 to 10 inches, grayish-brown to light brownish-gray friable stony loam; in wooded areas the upper 1 to 2 inches is a grayish-brown gritty loam stained dark with organic matter.
10 to 18 inches, light yellowish-brown friable stony heavy loam.
18 to 32 inches, yellowish-brown to brownish-yellow friable stony clay loam or sandy clay loam with a moderately developed medium blocky structure.
32 inches +, yellowish-brown, brownish-yellow, or reddish-yellow friable sandy clay loam, faintly mottled with gray, brown, and yellow.

The soil is strongly acid and is apparently moderately well supplied with organic matter and plant nutrients. Numerous sandstone and quartzite fragments 1 to 8 inches across are on the surface and throughout the profile. The soil is permeable to air, roots, and water. Runoff and internal drainage are medium. The water-supplying capacity is moderate.

Use suitability.—Practically all of this soil is in forest. A little is cleared and used for crops or pasture and a very small part is idle or in nonfarm uses.

This soil is well suited to most of the common crops grown in the county and is especially well suited to tobacco. It is deficient in lime and most of the major plant nutrients for most crops. Fertilization is required to increase or maintain crop yields. Lime and phosphate are essential for crops such as alfalfa and red clover. The soil is

somewhat difficult to till because of the prevalence of stones. It is moderately susceptible to erosion, but erosion control is not a serious problem under a high level of management. For a discussion of use and management, see group 5 in the section on Use and Management of Soils.

Jefferson stony loam, eroded rolling phase (5–12% slopes) (JH).—This soil differs from Jefferson stony loam, rolling phase, chiefly in being eroded. A considerable part of the original surface soil, including the thin layer of higher organic-matter content, has been lost. All the surface soil has been lost in small spots and the subsoil is exposed. Although it is mixed with the subsoil in places, the present surface layer is not significantly heavier in texture. This soil is closely associated with Hayter, Ramsey, Sequatchie, Teas, and other Jefferson soils. Most of it is in the valley of Doe Creek, but small areas are in the valleys of Laurel and Roan Creeks.

The present surface layer is a grayish-brown to light yellowish-brown friable stony loam. The subsoil is yellowish-brown to brownish-yellow friable stony clay loam or sandy clay loam.

Use suitability.—Practically all of this soil has been cleared and cultivated. Various kinds of crops and pasture are grown in very irregular rotation.

This soil is suited to crops, but its high content of stone and gravel interferes with tillage. It is similar to Jefferson stony loam, rolling phase, in use and management requirements. As a result of erosion and cropping, it is somewhat lower in organic matter, plant nutrients, and water-supplying capacity and is more susceptible to further erosion. Longer rotations and somewhat heavier fertilization are required to maintain yields comparable to those of the rolling phase. The soil is susceptible to erosion under ordinary management, but erosion control is not a serious problem under a high level of management. For a discussion of use and management, see group 5 in the section on Use and Management of Soils.

Jefferson stony loam, hilly phase (12–25% slopes) (JL).—This well-drained stony soil of the colluvial lands occurs at the base of steep mountain slopes from which the parent materials have washed or rolled. It differs from Jefferson stony loam, rolling phase, mainly in having stronger slopes. It is also more variable in depth to bedrock and in size and amount of stones. The larger part of this soil is in the valleys of Doe and Roan Creeks, but some of it is also along Laurel Creek and in some of the other valleys. It is closely associated with Ramsey, Hayter, Teas, Litz, Sequatchie, Staser, Hamblen, and other Jefferson soils.

The surface layer is grayish-brown to light brownish-gray friable stony loam. The subsoil is yellowish-brown to brownish-yellow friable clay loam or sandy clay loam.

Use suitability.—All of this soil is in cutover forest. It is poorly suited to crops that require tillage but it is fair cropland. It has moderately steep slopes and enough stones to interfere substantially with tillage; consequently, it is difficult to work and to conserve. Good pastures can be established and maintained by proper use of amendments and by seeding. Available evidence indicates that the soil can be maintained under a high level of management that includes use of necessary amendments and a rotation that consists mainly of close-

growing crops. Stripcropping is an effective aid in controlling runoff and erosion and makes possible a more intensive use of the soil. A considerable part of the soil is relatively inaccessible and is probably best left in forest. For a discussion of use and management, see group 9 in the section on Use and Management of Soils.

Jefferson stony loam, eroded hilly phase (12–25% slopes) (JG).—This is a well-drained stony soil of the colluvial lands. It has formed from local alluvium or colluvium washed from Ramsey and associated soils. It differs from Jefferson stony loam, eroded rolling phase, chiefly in having steeper slopes. The soil is also more variable in such characteristics as stoniness, distinctness and thickness of soil layers, and depth of the colluvial deposit. Most of it is in the valleys of Doe and Roan Creeks, but some areas are in the valley of Laurel Creek. It is associated with Teas, Litz, Ramsey, Hayter, Elliber, and other Jefferson soils.

The surface soil ranges from 4 to 10 inches in thickness and is a grayish-brown to light yellowish-brown friable stony loam. The subsoil is a yellowish-brown or brownish-yellow moderately friable clay loam or sandy clay loam.

Use suitability.—All of this soil is cleared and has been used for crops and pasture. A wide variety of crops is grown—generally more close-growing crops or pasture than on the eroded rolling phase of Jefferson stony loam. A considerable part is idle or in nonfarm uses.

This soil is poorly suited to crops, and management requirements under this use are exacting. Because of the steeper slope, it is less desirable for crops than the eroded rolling phase of Jefferson stony loam, and more difficult to till. Control of runoff and erosion is also more difficult. If the soil is used for crops, adequate fertilization and use of long rotations consisting chiefly of close-growing legumes and grasses are required to maintain or increase yields. On most farms it probably will be more feasible to use the soil for pasture than to practice the level of management necessary to maintain it in a crop rotation. Fair to good pastures can be established and maintained under a high level of management that includes adequate application of lime and phosphate. For a discussion of use and management, see group 9 in the section on Use and Management of Soils.

Jefferson stony loam, steep phase (25–60% slopes) (JN).—This is a well drained to excessively drained steep, stony, light-colored soil of the colluvial lands. It is at the base of steep or very steep mountain slopes from which its parent materials have rolled or washed. It differs from the hilly phase mainly in having a steeper slope. In addition, the surface soil and subsoil layers are less distinct than in the hilly phase, the average depth of profile is less, and the size and amount of stones are more variable. Boulders 10 to 20 inches across are common in many places. This soil occurs in relatively large areas on the outer edges of the valleys of Doe and Roan Creeks. A limited acreage is in the valley of Laurel Creek and some of the smaller valleys. It is closely associated with Ramsey, Hayter, Teas, Elliber, Sequatchie, and other Jefferson soils.

The surface soil is grayish-brown or light brownish-gray friable stony loam. The subsoil is yellowish-brown to brownish-yellow friable stony clay loam or sandy clay loam to fine sandy loam.

Use suitability.—All of this phase is in cutover forest. The soil is very difficult to work and conserve, and the productivity is low for most crops. The soil has a low water-supplying capacity, and is moderately low in most plant nutrients. It is not considered suitable for crops and is poorly suited to pasture. A high level of management that includes proper seeding, the use of amendments, and careful control of grazing is generally necessary for establishing and maintaining good pasture. Weed control is also very difficult on this soil. On most farms the soil is probably best used for forest. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Jefferson stony loam, eroded steep phase (25–60% slopes) (JK).—This well drained to excessively drained soil differs from Jefferson stony loam, eroded hilly phase, chiefly in having a steeper slope. Like that soil, it has formed on foot slopes from material washed or rolled from Ramsey soils, but its profile is shallower on the average, contains more and larger stones, and has less distinct surface soil and subsoil layers. Most of the acreage of Jefferson stony loam, eroded steep phase, is in the valleys of Doe and Roan Creeks. The soil is closely associated with Ramsey, Hayter, Teas, Elliber, and other Jefferson soils.

The present surface layer varies from grayish-brown to light yellowish-brown friable stony loam. The subsoil is a yellowish-brown to brownish-yellow friable stony clay loam or sandy clay loam to fine sandy loam. Most of the stones on the surface and throughout the soil are 2 to 10 inches across, but boulders 10 to 20 inches across are not uncommon.

Use suitability.—All of this soil is cleared of its forest cover and has been used for crops and pasture. A considerable part is now idle, however, and a small acreage has been abandoned and is reverting to forest.

The soil has steep slopes and enough stones to interfere materially with tillage and is therefore very difficult to work and conserve. It is not considered suitable for crops and it is poorly suited to pasture. The fertility level is low, and lime and fertilizers will be needed to establish and maintain productive pastures. The control of weeds is very difficult in pastures. The soil is thought to be best suited to forest under most conditions. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Made land (2–7% slopes) (M).—This well-drained land type is composed mainly of soil material and some ore from mine washings that have been allowed to settle on the flood plains of the streams in which manganese ore is washed. The ore was mined from material underlying Elliber or Teas and Litz soils. Practically all of the Made land mapped is in the valley of Roan Creek. The mine washings in the valley of Doe Creek and in Shady Valley were spread in a thin layer over the soils of the bottom lands and are included with those soils in mapping.

In most places Made land consists of yellowish-brown or light yellowish-brown friable silty clay to depths of 36 inches or more. It is underlain by Hamblen or Staser soils.

Use suitability.—Practically all of this land type is cleared and used for crops and pasture. Suitability for crops and pasture varies greatly

from place to place but is apparently good in most places. Like the soils on the flood plains, however, this land is limited in use suitability because of periodic flooding. A good sod of bluegrass and white clover was observed on one area in Roan valley, and corn yields of as much as 75 bushels an acre have been reported. For a discussion of use and management, see group 2 in the section on Use and Management of Soils.

Masada silt loam, undulating phase (2–5% slopes) (Mc).—This is a well-drained soil of the high stream terraces. The parent materials have washed chiefly from uplands underlain by granite, gneiss, and schist but they include in most places some material from quartzite, shale, siltstone, conglomerate, and sandstone. In places the original surface soil has been removed to a considerable extent by erosion, but in most areas it still makes up most of the plow layer. This soil is mainly on high terraces of the Watauga River. It is largely confined to the Masada-Congaree soil association area and is closely associated with Congaree, Elliber, Teas, and Ramsey soils and Stony colluvium, Tusquitee soil material.

Profile description:

0 to 10 inches, dark-brown or brown mellow friable silt loam.
10 to 34 inches, yellowish-red friable clay loam or silty clay loam with a moderate medium blocky structure.
34 to 48 inches +, brownish-yellow or yellowish-red to light reddish-brown friable clay loam, sandy clay, or silty clay, faintly mottled with gray below about 40 inches; limestone or calcareous shale at depths of 6 to 20 feet in most places.

The soil is medium to strongly acid and apparently contains a moderate amount of organic matter and plant nutrients. In small quantity, quartzite gravel and cobbles are on the surface and throughout the soil in many places; a small acreage has enough to interfere materially with tillage. The soil is permeable to air, roots, and water. Runoff is slow to medium and internal drainage is medium. The water-supplying capacity is relatively high.

Use suitability.—Practically all of this soil has been cleared and cultivated. Very little is ever idle. A wide variety of crops is grown and yields are relatively high.

This soil is well suited to the production of practically all the common crops of the county, including pasture. Although the soil is moderately productive under the present management, it is responsive to better management practices. It is deficient in lime, phosphate, and nitrogen for continued high yields of most crops. The supply of potash is apparently adequate for most crops, and the need for this plant nutrient will depend largely on the crop and the past cropping system. Lime and phosphate are essential in most places for the successful growth of alfalfa or red clover. The soil is only slightly susceptible to erosion, so control of runoff and erosion is a minor problem under a good system of management. For a discussion of use and management, see group 2 in the section on Use and Management of Soils.

Masada silt loam, eroded rolling phase (5–12% slopes) (Mb).—This is a brown well-drained soil of the stream terraces. The alluvium from which the soil has formed was washed chiefly from Ashe, Porters, and associated soils of the uplands. This soil differs from Masada silt

loam, undulating phase, chiefly in being more eroded and in having steeper slopes. About one-half to two-thirds of the original surface soil has been lost as a result of erosion. The present surface layer is slightly heavier than that of the undulating phase but not heavy enough to affect significantly the workability of the soil. The subsoil is exposed in some severely eroded spots. This soil is largely confined to the Masada-Congaree soil association. It is closely associated with Congaree, Elliber, Teas, Ramsey, and other Masada soils.

The present surface layer is brown to yellowish-brown friable silt loam or heavy silt loam. The subsoil is a yellowish-red friable clay loam or silty clay loam. A small acreage that is uneroded and other small areas that are sufficiently gravelly to interfere materially with tillage are included in mapping.

Use suitability.—Practically all of this soil has been cleared and used for crops and pasture. Possibly 10 percent of the soil is idle or in nonfarm uses.

This soil is well suited to the production of most of the common field crops and pasture plants of the county. It is less desirable for crop production, however, than Masada silt loam, undulating phase, but has somewhat similar use and management requirements. It contains less organic matter and plant nutrients than the undulating phase because of soil loss through cropping and erosion. The water-supplying capacity is also slightly lower, and the soil is more susceptible to erosion. To maintain crop yields at a comparable level will require a longer rotation that includes more legumes and grasses, and possibly somewhat heavier or more frequent applications of lime and phosphate. Runoff is more rapid and erosion control is more difficult, but these are not serious problems under a high level of management. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Masada silt loam, eroded hilly phase (12–25% slopes) (MA).—This is a brown well-drained soil on old stream terraces. It formed from alluvium washed chiefly from Ashe, Porters, and associated soils of the mountains. This soil differs from the eroded rolling phase of Masada silt loam chiefly in having stronger slopes. It is somewhat more variable in depth of alluvial deposit and in the distinctness and thickness of the soil layers. It is also somewhat more stony, although stones interfere materially with tillage in only a few places. The soil occurs on high terraces of the Watauga River in association with Congaree, Teas, Elliber, Ramsey, and other Masada soils.

The 4- to 8-inch surface soil is a brown to yellowish-brown friable silt loam. In places, however, erosion has removed all of this layer. The subsoil is a yellowish-red friable silty clay loam to clay loam.

Use suitability.—All of this soil has been cleared and cultivated. A major part is in hay and pasture, some is in tilled crops, and a considerable part is idle or abandoned and reverting to forest. Crop and pasture yields are generally low.

This soil is only fairly well suited to the production of intertilled crops and is probably best used on most farms for growing semipermanent hay crops or pasture. Pasture yields without amendments are low, but good pastures can be established and maintained by the use of adequate quantities of lime and phosphate and by control of grazing. The soil can be maintained in a long rotation consisting main-

ly of close-growing crops. It is very susceptible to erosion and runoff; and if intertilled crops are grown, erosion control is a problem even under a high level of management. The slopes are generally too short for stripcropping, but contour tillage should lessen the loss of soil material. For a discussion of use and management, see group 6 in the section on Use and Management of Soils.

Matney loam, eroded rolling phase (5–12% slopes) (Me).—This is a light-colored well-drained soil of the mountain crests or plateaus. It is largely derived from materials weathered from quartzite, shale, siltstone, conglomerate, and sandstone. Most of the soil has lost a considerable part of the original surface layer, although a part is uneroded. The present surface layer is variable in thickness (3 to 10 inches), and in color ranges from grayish brown through yellowish brown to pale yellow. It has been mixed with the subsoil to some extent, but the texture is not significantly heavier or less friable. All the original surface layer is missing in places. Practically all of this soil is on Cross Mountain, but a small acreage is widely distributed throughout the Ramsey soil association. The soil is commonly on the mountain slopes above steep and stony Ramsey soils. It differs from the Ramsey soils in being deeper over bedrock and in having distinct surface soil and subsoil layers.

Profile description:

0 to 8 inches, very friable pale-brown to brown loam of weak fine crumb structure; in wooded areas the surface inch is a dark grayish-brown loose loam or fine sandy loam.

8 to 30 inches, yellowish-brown to brownish-yellow friable clay loam of weak medium blocky structure.

30 inches +, yellow to brownish-yellow friable clay loam or sandy clay loam, faintly mottled with gray; in most places bedrock is at depths of 3 to 5 feet.

The soil is medium to strongly acid and apparently low in organic matter. It is relatively low in plant nutrients. A few small quartzite fragments are on the surface and throughout the profile in most places but do not interfere with tillage materially. The soil is very permeable to air, roots, and water, but the water-supplying capacity is only moderate. Runoff is slow to medium and internal drainage is medium.

A variation, largely confined to Cross Mountain, that differs from the soil described in being heavier and darker throughout the profile, is included. This variation is characterized by a grayish-brown friable silt loam or loam surface soil and a brown friable silty clay loam subsoil. It is more fertile than the soil described, and higher crop yields may be expected from it under the common level of management.

Use suitability.—Most of this soil has been cleared and largely used for pasture or subsistence crops, chiefly vegetables. The yields of both pasture and crops are low under common management.

This soil is suited to the production of most of the common crops and pasture. It is moderately deficient in lime, phosphate, potash, and nitrogen for most crops; and it is highly responsive to management that includes their application. However, high yield levels are more difficult to maintain than on the finer textured soils of the limestone valleys. Lime and phosphate are essential for success with many crops, including the deep-rooted legumes. Because of the favor-

able distribution of rainfall at the relatively high altitude, crops rarely suffer from droughts. Although this soil is suited to crops and pasture, many areas are so isolated by large areas of steep stony Ramsey soils that it is not feasible to farm them. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Matney loam, eroded hilly phase (12–25% slopes) (MD).—This is a well-drained light-colored soil derived from materials weathered mainly from quartzite, shale, siltstone, conglomerate, and sandstone. The soil differs from Matney loam, eroded rolling phase, chiefly in having steeper slopes. It also has a somewhat shallower surface soil and thinner subsoil layer, and is more variable in profile characteristics. It is confined to high ridge slopes or ridge crests in the Ramsey soil association, mainly on Cross Mountain, and is closely associated with Ramsey and other Matney soils.

The surface soil is a light brownish-gray to brown very friable loam, though in some of the more eroded spots it is yellowish brown. The subsoil is a yellowish-brown to brownish-yellow friable clay loam.

Use suitability.—Most of this soil is cleared and has been used for crops and pastures, although a considerable part is idle or abandoned. It is fairly well suited to crops and pasture but somewhat difficult to work and conserve. Crop yields are low under common management. The soil has moderately steep slopes, is low in content of organic matter and plant nutrients, and moderately low in water-supplying capacity. It is, however, responsive to good management that includes the proper use of amendments and provides adequate control of runoff and erosion. The soil is erosive, so a long rotation consisting mainly of close-growing crops is best suited. Contour stripcropping will generally make possible more intensive use of soil. For a discussion of use and management, see group 7 in the section on Use and Management of Soils.

Mine pits (MF).—This land type consists of open manganese mine pits and limestone quarries. The areas are very small and practically worthless for agriculture. Forest trees are becoming reestablished in some of the old abandoned areas, especially where there is enough soil material. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Perkinsville loam, hilly phase (12–25% slopes) (PB).—This is a light-colored well-drained soil on mountain crests or plateaus. It is derived chiefly from materials weathered from granite, granite gneiss, and schist. The soil is widely distributed in the Ashe-Tusquitee-Perkinsville soil association. It occurs on mountain crests above steep Ashe soils in association with Ashe, Tusquitee, and other Perkinsville soils.

Profile description:

0 to 8 inches, grayish-brown to brown very friable loam; pale brown when dry; weak fine crumb structure; in wooded areas the upper 2 inches of the surface layer is dark grayish brown and high in organic matter.

8 to 24 inches, light-brown to yellowish-brown or brownish-yellow friable gritty clay loam with a weak medium blocky structure.

24 inches +, yellowish-brown to yellow or pale-yellow clay loam mixed with partially weathered rock; bedrock at depths of 3 to 6 feet in most places.

The soil is strongly acid and apparently low in organic matter. In most places it is moderately low in plant nutrients and virtually stone-free. It is very permeable to air, roots, and water. Rainfall is readily absorbed and moderately well retained. The water-supplying capacity is moderate. Runoff is rapid and internal drainage is medium.

Use suitability.—Although this soil is in forest at the present time, accessible areas are moderately well suited to pasture. Low yields of low quality pasture can be expected without amendments, but the soil is particularly responsive to lime and phosphate. Owing to the favorable distribution of rainfall and cool summer temperatures, very good pastures can be maintained throughout the summer if they are properly fertilized. The soil is moderately well suited to crop production if it is used in a long rotation that consists chiefly of close-growing crops and includes grasses and legumes. The lime, phosphate, and nitrogen content is low in most areas, but potash is apparently adequate for most crops. The soil is moderately to highly susceptible to erosion, and control of runoff and erosion is a problem even under good management. Many of the slopes are suitable for stripcropping, which would make possible a much shorter rotation. For a discussion of use and management, see group 7 in the section on Use and Management of Soils.

Perkinsville loam, eroded hilly phase (12–25% slopes) (PA).—This is a light-colored well-drained soil of the mountain uplands that was derived chiefly from materials weathered from granite, granite gneiss, and schist. It differs from Perkinsville loam, hilly phase, mainly in being eroded. About 25 to 75 percent of its original surface soil has been lost. The subsoil is exposed in small severely eroded spots and in places some of the upper part has been washed away. This soil is associated with Ashe, Porters, Tusquitee, and other Perkinsville soils in the Ashe-Tusquitee-Perkinsville soil association area.

The present surface soil ranges from about 4 to 8 inches in thickness and consists of a grayish-brown to yellowish-brown friable loam. The subsoil consists of yellowish-brown to brownish-yellow friable clay loam. The soil varies considerably in depth to bedrock (3 to 6 feet in most places), in texture, and in distinctness of surface soil and subsoil layers. An occasional bedrock outcrop is not uncommon. A small acreage having slopes of 5 to 12 percent is included.

Use suitability.—All of this soil has been cleared and much of it has been cultivated. It is estimated that about 25 percent is now idle, a part of which is reverting to forest.

In use and management this soil is similar to Perkinsville loam, hilly phase; but chiefly because of cropping and erosion injury, it is somewhat less desirable for either crops or pasture. Loss of original surface soil has resulted in a decrease in organic-matter and plant-nutrient content, water-supplying capacity, and productivity for most crops. In addition, susceptibility to erosion has been increased. However, a part of this soil, particularly that on milder slopes, is moderately well suited to crops grown in a long rotation. Close-growing crops, such as small grains, grasses, and legumes, will need to be favored. Stripcropping on suitable slopes will permit a more intensive use of the soil. On many farms the soil, especially on the steeper areas, is best used for permanent pasture. Lime and phosphate are generally required to produce good quality pastures. For a discussion

of use and management, see group 7 in the section on Use and Management of Soils.

Porters loam, steep phase (25–60% slopes) (PE).—This is a brown excessively drained soil on steep mountain slopes, knobs, and ridges. It has formed from materials weathered from mica gneiss and mica schist and some granite, hornblende gneiss, hornblende schist, and diorite. It differs from Porters stony loam, steep phase, chiefly in being less stony. It is closely associated with Ashe, Perkinsville, Tusquitee, and other Porters soils, chiefly in the Porters-Tusquitee-Clifton soil association area. A small part is in the Ashe-Tusquitee-Perkinsville soil association area.

Profile description:

0 to 8 inches, dark-brown to brown very friable loam; moderate medium crumb structure; the upper 2 to 3 inches in wooded areas is a dark grayish-brown loose loam, very high in organic matter.
8 to 30 inches, strong-brown to yellowish-brown friable loam to clay loam with weak fine blocky structure.
30 inches +, yellowish-brown or brownish-yellow loam or clay loam containing a variable number of gray partly decomposed soft rock fragments; bedrock at depths of 2 to 5 feet in most places.

The soil is medium to strongly or very strongly acid, moderately well supplied with plant nutrients, and apparently moderately high in organic-matter content. In general it is relatively stone-free, but a few areas may be stony. Mica flakes are common throughout the profile. The soil is very permeable to air, roots, and water. Runoff is rapid to very rapid and internal drainage is medium. The water-holding capacity is moderate to moderately low.

A few small areas are included that differ from the soil described in having a brownish-black surface layer 8 to 12 inches thick that is relatively high in organic matter. Some areas included differ in having a somewhat heavier textured light reddish-brown subsoil.

Use suitability.—Practically all of this soil still has a forest cover. Owing to the steep slopes, it is not considered suitable for crops under most conditions. It is well suited to permanent pasture if properly managed. Good pasture management includes adequate applications of lime and phosphate and careful control of grazing so as to maintain a good sod. Poor pasture management generally results in a gradual lowering of organic-matter content, plant nutrients, and water-holding capacity; consequently, yields gradually become less and susceptibility to erosion increases. Unless pastures are to be properly managed, the soil is best left in forest. For a discussion of use and management, see group 13 in the section on Use and Management of Soils.

Porters loam, eroded steep phase (25–60% slopes) (PD).—This is a brown excessively drained soil on steep mountain slopes. It consists of materials weathered from rocks similar to those that gave rise to Porters loam, steep phase, and differs from that phase chiefly in being eroded. A considerable part of the original surface layer, including the thin dark-colored layer of high organic-matter content, has been lost as a result of erosion. The loss of material has been uneven over the area, however, and the present surface layer is highly variable in thickness and color. This soil is widely distributed in the Porters-Tusquitee-Clifton soil association, and a small part is in the Ashe-Tusquitee-Perkinsville soil association.

The present surface layer is dark-brown or brown to yellowish-brown friable loam. The subsoil is strong-brown to yellowish-brown friable loam to clay loam.

Use suitability.—All of this soil is cleared and has been used for crops and pasture. It is now mostly used for pasture, but some of it is in crops and some is idle. Mainly because of the steep slopes, this soil is considered poorly suited to crops that require tillage. It is well suited to permanent pasture if amendments are properly used and grazing is carefully controlled. There is evidence that the soil can be maintained in a crop rotation by practicing contour stripcropping. This requires the use of needed amendments, especially on the sod strips. For a discussion of use and management, see group 13 in the section on Use and Management of Soils.

Porters loam, eroded hilly phase (12–25% slopes) (Pc).—This is a brown excessively drained to well drained soil of the mountain uplands. It differs from the steep phase of Porters loam in being moderately eroded and in having milder slopes. Enough of the original surface layer has been removed by erosion to bring the subsoil within ordinary plow depth in more than half the area. The original surface soil remaining is about 3 to 7 inches deep in most places, but in some small spots the subsoil is exposed. This soil is closely associated with Ashe, Tusquitee, and other Porters soils, chiefly in the Porters-Tusquitee-Clifton and Ashe-Tusquitee-Perkinsville soil associations.

The present surface layer is brown to yellowish-brown friable loam, and the subsoil is strong-brown to yellowish-brown friable loam to clay loam. Stones 2 to 10 inches across are sufficiently numerous on the surface in a few small areas to interfere materially with tillage. A small acreage is included that has a brownish-black surface layer 6 to 10 inches thick. Another small included area has 5 to 12 percent slopes.

Use suitability.—Practically all of this soil has been cleared and used for crops or pasture. Most of it is now in pasture or hay crops, but a small acreage is in tilled crops and a part is idle. Crop yields are generally low, but pasture yields are fair.

Because it is difficult to work and susceptible to erosion, this soil is generally better suited to pasture than to crops that require tillage. It has been demonstrated, however, that crop yields can be increased and maintained under management that includes the proper use of amendments and a long rotation consisting chiefly of close-growing crops. Contour stripcropping permits more intensive use of the soil. Fair pastures are obtained without the use of amendments, but a good response is expected from the use of lime and phosphate. The soil is deficient in lime, phosphate, and nitrogen for most crops, but the potash content is adequate for high yields of most crops. For a discussion of use and management, see group 7 in the section on Use and Management of Soils.

Porters stony loam, steep phase (25–60% slopes) (Pg).—This is a brown excessively drained stony soil of steep mountain slopes, knobs, and ridges. It has formed from materials weathered from mica gneiss and mica schist, and some granite, hornblende gneiss, hornblende schist, and diorite. It differs from Porters loam, steep phase, in being more stony. The soil is closely associated with Ashe, Perkinsville,

Tusquitee, and other Porters soils. Most of the acreage is in the Porters-Tusquitee-Clifton and Ashe-Tusquitee-Perkinsville soil associations.

Profile description:

0 to 7 inches, dark-brown to brown very friable stony loam; in wooded areas the top 2 inches of this surface layer is a brown or dark grayish-brown loose loam.
7 to 28 inches, strong-brown to yellowish-brown friable stony loam to light clay loam with a weak fine blocky structure.
28 inches +, yellowish-brown or brownish-yellow loam or clay loam containing a variable number of gray partly decomposed soft rock fragments; bedrock at depths of 2 to 5 feet in most places.

The soil is medium to strongly or very strongly acid throughout the profile and apparently has a relatively high content of organic matter. It is moderately well supplied with plant nutrients. Numerous stones are on the surface and throughout the profile in sufficient quantities to interfere with tillage. They vary greatly in size, generally from 2 to 10 inches across, but a few boulders are present in most places and an occasional bedrock outcrop is not uncommon. Mica flakes occur throughout the profile. Runoff is rapid to very rapid and internal drainage is medium. The water-holding capacity is moderately low to moderate.

As mapped, this soil includes small areas of the associated soils. Some areas, especially those above 3,500 feet in elevation, have a darker surface soil that is higher in organic matter than the soil described. In some areas at the lower elevations, the subsoil is reddish in color.

Use suitability.—All of this soil is now in forest; and owing to the stoniness and steep relief, this use is generally considered most suitable. On some farms the soil must be used for pasture, and if properly managed, good pastures can be maintained on the less steep parts. Lime and phosphate are needed but are difficult to apply. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Porters stony loam, eroded steep phase (25–60% slopes) (PF).—This is a brown excessively drained stony soil on steep mountain slopes. It has formed from parent rocks similar to those of Porters stony loam, steep phase, but differs chiefly in being moderately eroded. From 25 to 75 percent of the original surface soil, including the thin surface layer of higher organic matter content, has been lost. Some small areas have lost most or all of the surface soil, and in places a part of the subsoil. The soil is largely confined to the Porters-Tusquitee-Clifton and Ashe-Tusquitee-Perkinsville soil association areas.

The present surface layer is 3 to 7 inches thick and consists of brown to yellowish-brown friable stony loam. The subsoil is a strong-brown to yellowish-brown friable stony loam or clay loam.

Use suitability.—All of this soil has been cleared and used for crops and pasture. Much of it is now in pasture, a small part is in crops, and a much larger part is idle and partly reverting to forest. Crop yields are commonly low, but pasture yields, even without amendments, are fair.

This phase is similar to Porters stony loam, steep phase, in use suitability. However, it is somewhat lower in content of organic matter and plant nutrients, has a lower water-holding capacity, and is more susceptible to further erosion. Because of steepness and stoniness,

forestry is considered its best use; but the less steep parts of the accessible areas are fairly well suited to pasture. A good pasture response can be expected from the use of lime and phosphate, but application is difficult. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Prader silt loam (0–2% slopes) (PH).—This is a gray poorly drained soil derived mainly from alluvium washed from Ramsey, Teas, and Litz soils. This alluvium consists of materials from quartzite, shale, siltstone, conglomerate, sandstone, and some dolomite. The soil occupies bottom lands lying a little higher than the normal level of the streams. Many areas, especially those along the larger streams, are in old stream channels. Much of the soil receives considerable seepage from the adjacent upland slopes. Water remains on the surface during much of the year, and the water table remains near the surface at all times. The native vegetation was largely water-tolerant oaks, willow, and sweetgum. This soil is in small tracts widely distributed in all the major valleys, but the largest acreage is in Shady Valley. It is closely associated with Staser, Hamblen, Dunning, Sequatchie, and Hayter soils.

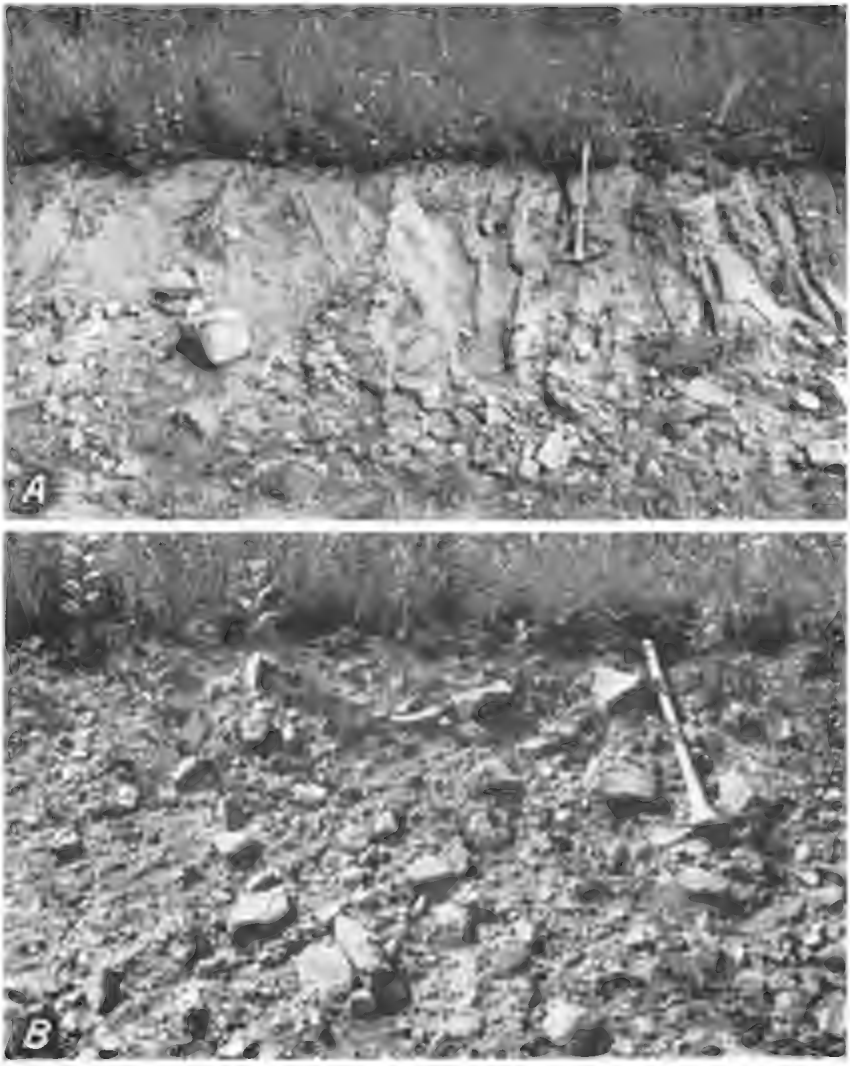
Profile description:

0 to 10 inches, gray to dark-gray friable silt loam mottled with yellow and reddish brown.
10 to 20 inches, gray friable (when moist) to plastic (when wet) heavy silt loam or silty clay loam mottled with yellow and reddish brown.
20 inches +, gray or light-gray plastic silty clay or heavy silty clay loams; the thickness of the alluvium varies from 4 to 10 feet or more.

The soil is nearly neutral to slightly acid and has a moderate amount of plant nutrients. It is medium to high or very high in organic matter. When not saturated with water, it is slightly to very permeable to air, roots, and water. Both runoff and internal drainage are poor. The high water table greatly restricts development of the root system of many crops. The soil varies greatly in texture of the lower layers and in underlying material. In Shady Valley it has a texture similar to or heavier than in the profile described and is underlain by limestone at depths of 3 to 5 feet in most places. In the valleys of Roan, Doe, and Laurel Creeks, the soil is generally coarser textured than that in Shady Valley and is underlain by coarse sandy or gravelly material in many places.

Use suitability.—A large part of Prader silt loam has been cleared. Most of the cleared areas are in pasture, some are in crops, mainly corn, and an appreciable part has grown up in willow and alder thickets. Average yields of corn are low and total failures are common (pl. 6, *B*). Although artificial drainage can be expected to broaden use suitability, this soil would still be limited largely to summer annual crops, such as corn, soybeans, and sorghum. Moderate fertility and the ability to support vegetation during prolonged dry periods make Prader silt loam fairly well suited to pastures. For a discussion of use and management, see group 11 in the section on Use and Management of Soils.

Ramsey stony loam, steep phase (25–60% slopes) (RB).—This is a light-colored excessively drained stony soil on steep mountain slopes. It consists of materials weathered from quartzite, shale, siltstone, conglomerate, and sandstone. It differs from the Matney soils, also de-



A, Characteristic profile of Hayter loam soils showing the cobbly layers commonly occurring at depths of 3 to 5 feet.

B, Stones 2 to 8 inches across occur throughout the profile of Hayter stony loam soils. Stones are in sufficient quantities to interfere materially with tillage, lower the water-holding capacity, and modify the rate of runoff.

A, An area of Hayter stony loam, rolling phase, that has only recently been cleared of its forest cover, which was mainly white pine and hemlock with some hardwood. The stumps give some idea of the size and stand of timber in the original forest.

B, Corn on Prader silt loam; area enclosed by dotted line has been injured by excessive moisture.

A, Ramsey stony loam, steep phase, is an excessively drained stony soil shallow over quartzite bedrock.

B, Area of Ramsey stony loam, steep phase, that has been cleared and used for pasture. Pasture yields are very low and cleared areas generally revert to forest after a few years.

A, An apple orchard on Ramsey stony loam, hilly phase. If properly fertilized, this soil apparently can be successfully used for orchards. Stony colluvium, Jefferson soil material, is in the foreground.

B, An excellent crop of snap beans on Sequatchie silt loam, undulating phase.

rived from this type of parent material, mainly in being shallow over bedrock and in having less distinct surface soil and subsoil layers (pl. 7, *A*). This is a very extensive soil, widely distributed in the Ramsey, Ramsey-Jefferson, and Matney-Ramsey soil associations. The soil occurs in large areas and is associated with Jefferson, Hayter, Matney, and other Ramsey soils.

Profile description:

0 to 6 inches, brown to light yellowish-brown loose stony loam; in wooded areas the surface inch is stained dark gray with organic matter.
6 to 14 inches, yellowish-brown, brownish-yellow, or pale-brown friable stony loam or clay loam.
14 inches +, pale-brown clay loam or gritty sandy loam and thin layers of soft partially weathered rock fragments; unweathered bedrock at depths between 1½ and 3 feet in most places.

The soil is strongly or even very strongly acid and apparently low in organic-matter content except in the thin surface layer. It is low in practically all major plant nutrients. Sandstone and quartzite fragments 2 to 10 inches across are on the surface and throughout the profile. The soil is very permeable to air, roots, and water. Runoff is very rapid and internal drainage is rapid. The water-holding capacity is very low.

The soil varies greatly in texture and depth. It is a stony loam in most places, especially around the head of drainageways and in the deeper areas, but it is generally a stony fine sandy loam in the shallow steeper areas. In most places bedrock is at a depth of about 1½ feet, but it is as deep as 3 feet in some places and outcrops in others. A small acreage included has lost through erosion a considerable part of the original surface soil, including the thin surface layer of higher organic-matter content.

Use suitability. Practically all of this soil is still in forest. A large part is within the Cherokee National Forest. Owing to steepness, stoniness, shallow depth, and low fertility, forestry is considered its best use (pl. 7, *B*). For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Ramsey stony loam, hilly phase (12–25% slopes) (Ra).—This is a light-colored excessively drained stony soil of the mountain uplands. It has formed from parent material similar to that of Ramsey stony loam, steep phase, and differs from that soil chiefly in having less steep slopes. In general, this soil is also somewhat deeper, slightly less stony, and has fewer bedrock outcrops. It is extensive, but less so than Ramsey stony loam, steep phase. It occurs in the Ramsey, Ramsey-Jefferson, and Matney-Ramsey soil associations.

The surface soil is brown to light yellowish-brown loose stony loam. The subsoil is a yellowish-brown, brownish-yellow, or pale-brown friable stony loam or light clay loam. Bedrock is at depths of 2 to 3 feet in most places. A small acreage is included that differs in having lost a considerable part of the original surface layer as a result of erosion. Some included areas on ridge crests have slopes of 5 to 12 percent.

Use suitability.—Practically all of this soil is still forested. It is poor for crops, mainly because it is stony, low in fertility, low in water-holding capacity, and susceptible to erosion (pl. 8, *A*). It is also poor for pasture, but fair to good pastures can be established

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and maintained under a high level of management. For most crops and pasture plants, the soil is deficient in lime, nitrogen, phosphate, and potash. Stoniness and strong slopes make weed control difficult. For a discussion of use and management, see group 10 in the section on Use and Management of Soils.

Ramsey stony loam, very steep phase (60%+ slopes) (Rc).—This is a light-colored excessively drained stony soil on very steep mountain slopes. It differs from Ramsey stony loam, steep phase, chiefly in having a steeper slope. In general it is shallower over bedrock and more stony, and bedrock outcrops are more common. This soil is widely distributed throughout the Ramsey soil association and is the least extensive of the Ramsey soils.

The surface soil is a brown to light yellowish-brown loose stony loam. The subsoil is a yellowish-brown, brownish-yellow, or pale-brown friable stony loam or light clay loam. In wooded areas the surface layer, 1 or 2 inches thick, is stained dark gray with organic matter.

Use suitability.—Practically all of this soil is still in forest, and a large part is within the Cherokee National Forest. Because of the very steep slopes, shallow depth, stoniness, and low fertility, this soil is considered unsuited to either crops or pasture. Forestry is its best use, although it is not very productive of forests. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Sequatchie loam, undulating phase (2–5% slopes) (Sc).—This is a brown well-drained soil of the low stream terraces. The parent material consists of general alluvium washed largely from uplands underlain by quartzite, shale, siltstone, conglomerate, and sandstone, together with a small admixture of material from dolomite. The soils on the uplands from which the alluvial material has washed are chiefly the Ramsey, Teas, and Litz. In this county the soil is underlain by limestone or calcareous shale at a depth of 4 feet or more. It occurs in small- to medium-sized irregularly shaped areas and on low terraces along most of the larger creeks in all except the extreme eastern part of the county. It is closely associated with Staser, Hamblen, Hayter, Jefferson, and other Sequatchie soils.

Profile description:

0 to 10 inches, brown to grayish-brown very friable loam; weak fine crumb structure.
10 to 30 inches, yellowish-brown to strong-brown friable light clay loam of weak fine to medium blocky structure.
30 inches +, strong-brown to brownish-yellow very friable gritty loam or sandy loam, mottled with gray, yellow, and brown in most places; much gravel and many cobbles in the lower part of this horizon in most places.

In most places the soil is medium to strongly acid, but in some it is only slightly acid. It is moderately well supplied with most plant nutrients and appears to be moderately high in organic matter. The few cobbles that occur locally on the surface and throughout the soil do not interfere materially with cultivation. Good tilth is maintained with ease, and tillage can be carried on over a fairly wide range of moisture conditions. Plant roots penetrate the soil readily, and soil air and moisture circulate freely. The moisture-holding properties are only moderately good, but the position of the soil in the land-

scape is such that the supply of moisture for growing plants is ordinarily adequate. Runoff and internal drainage are medium. Although some areas are overflowed at infrequent intervals, most of the soil is not subject to flooding.

Use suitability.—All of this soil has been cleared and used for crops and pasture. It is used intensively for crops such as corn, small grains, tobacco, beans, and all the common hay crops. Only a very small part is ever idle.

This soil is well suited to a wide variety of crops and can be used intensively for intertilled crops if adequately limed and fertilized. It is somewhat deficient in lime, phosphate, potash, and nitrogen for high yields of most crops, but crops respond readily to application of these amendments. If properly fertilized, the soil can be maintained under a short rotation. It is only slightly susceptible to erosion; and when crops are rotated and adequately fertilized, water control is not a problem. For a discussion of use and management, see group 2 in the section on Use and Management of Soils.

Sequatchie cobbly loam, undulating phase (2–5% slopes) (SB).—This is a brown well-drained cobbly soil of the low stream terraces. The parent alluvium is mostly from the same kinds of rock as that of Sequatchie loam, undulating phase. It consists of general alluvium washed from Ramsey, Hayter, Jefferson, and associated soils. In most places it includes a small admixture of material washed chiefly from Teas, Hagerstown, or Elliber soils. This soil differs from Sequatchie loam, undulating phase, chiefly in having enough gravel and cobbles on the surface and throughout the profile to interfere substantially with tillage. This soil is on low terraces of Roan, Doe, Laurel, and Cobb Creeks, and a silt loam variation is along Beaverdam Creek. It is associated with Staser, Hamblen, Hayter, Jefferson, and other Sequatchie soils.

The surface soil is a grayish-brown or brown very friable cobbly loam. The subsoil is a yellowish-brown or strong-brown friable cobbly light clay loam. This soil, as mapped, includes some soils with parent materials that contain a considerable admixture of materials derived from granitic rocks.

Use suitability.—All of this soil has been cleared and is used intensively for crops such as corn, small grain, beans, tobacco, and the common hay crops. It is well suited to all the common crops of the county. It is moderately productive and is responsive to good management, but gravel and cobbles interfere with tillage. The soil needs lime, phosphate, nitrogen, and potash to maintain high yields of most crops. The moisture-supplying capacity is lower than for Sequatchie loam, undulating phase, and expectable yields are not so high. Runoff is slow, and the problem of erosion control is negligible. For a discussion of use and management, see group 4 in the section on Use and Management of Soils.

Sequatchie cobbly loam, eroded rolling phase (5–12% slopes) (SA).—This is brown well-drained cobbly soil on low stream terraces. It has formed from general alluvium originating mainly in rocks similar to those for Sequatchie loam, undulating phase. It has washed from soils such as the Ramsey, Hayter, Jefferson, Teas, Litz, and Elliber. The soil differs from Sequatchie cobbly loam, undulating phase, in being moderately eroded and more strongly sloping. A

considerable part of the original surface layer has been lost as a result of erosion, and the present surface layer varies considerably in color. This soil is in long narrow areas, mainly on sloping terrace escarpments of Roan, Doe, and Cobb Creeks. A cobbly silt loam variation is on the terraces of Beaverdam Creek. The soil is associated with Staser, Hamblen, Hayter, Jefferson, and other Sequatchie soils.

The surface layer is a grayish-brown to yellowish-brown friable cobbly loam that is slightly heavier textured in the more eroded spots. The subsoil consists of yellowish-brown to strong-brown friable cobbly light clay loam. A few areas are included with this soil in mapping that have somewhat stronger slopes than average,

Use suitability.—Practically all of this soil is cleared and used for the common crops of the county. This soil is farmed less intensively than the other Sequatchie soils; longer rotations that use hay crops and pasture more of the time are followed. There is also a larger idle acreage.

This soil is not so well suited to crop production as the other Sequatchie soils, mainly because of its stronger slopes and consequently greater conservation problem. It will require longer crop rotations that include more closely-growing crops and more attention to runoff and erosion control. Like the other soils of the series, it produces fairly well without fertilization, but liberal use of amendments is required to increase yields to a relatively high level and maintain them. The soil does not have enough lime, phosphate, nitrogen, and potash for most crops and is very responsive to proper applications of these amendments. Stoniness interferes with tillage and limits the use suitability to some extent. For a discussion of use and management, see group 4 in the section on Use and Management of Soils.

Sequatchie silt loam, undulating phase (2–5% slopes) (SD).—This is a brown well-drained soil of the low stream terraces. The alluvium from which the soil was derived washed from uplands underlain by a wide variety of rocks, including quartzite, shale, siltstone, conglomerate, sandstone, and some dolomite. Material from shale or other fine-textured rock is apparently predominant. The soils from which the material has washed are mainly the Ramsey, Teas, and Litz. The alluvium is underlain by limestone or calcareous shale at a depth of 4 feet or more. This soil is finer textured and has somewhat more distinct surface soil and subsoil layers than Sequatchie loam, undulating phase. It is on terraces along Beaverdam, Roan, Doe, Town, Goose, and Laurel Creeks that generally lie somewhat higher than the terraces on which the other Sequatchie soils occur. It is closely associated with the Staser, Hamblen, Prader, Hayter, Ramsey, Teas, and other Sequatchie soils.

Profile description:

0 to 10 inches, dark grayish-brown to brown very friable mellow silt loam; weak fine crumb structure.

10 to 30 inches, yellowish-brown to strong-brown friable clay loam or silty clay loam; weak medium blocky structure.

30 inches +, yellowish-brown to brownish-yellow or even yellowish-red friable clay loam, faintly mottled with gray, yellow, and brown; numerous shale fragments and quartzite cobbles and gravel in most places.

The soil is slightly to medium acid and apparently well supplied with most plant nutrients and organic matter. Locally there are a few cobbles on the surface and throughout the soil, but they are not a tillage problem. The soil can be tilled over a fairly wide range of moisture conditions without injury. Roots penetrate the soil readily, and soil air and moisture circulate freely. The water-supplying capacity is high. Both runoff and internal drainage are medium.

Some areas included with this soil are only imperfectly or moderately well drained and the subsoils are predominantly brownish yellow in color; other included areas are loam or fine sandy loam in texture. These variations, however, do not differ greatly in use and management from the soil described.

Use suitability.—Practically all of this soil is cleared and used rather intensively for crop production. A wide variety of crops are grown but not commonly in a systematic rotation. Some of the soil is in rotation pasture but very little is in permanent pasture.

The soil is very well suited to most of the common crops of the county, including tobacco, red clover, and truck crops (pl. 8, *B*). Good crop yields are commonly obtained without fertilization or systematic crop rotation; but the soil is responsive to good management, including proper rotation and fertilization. It is suited to intensive use for row crops if organic-matter and fertility levels are maintained by using crop residues, green manure, barnyard manure, and commercial fertilizers. The soil has inadequate phosphorus and potash for continued high yields, but the content of lime is generally adequate. It should be tested, however, before such exacting crops as alfalfa and red clover are grown. For a discussion of use and management, see group 2 in the section on Use and Management of Soils.

Shouns silt loam, eroded rolling phase (5–12% slopes) (SF).—This is a well-drained soil of the old colluvial lands. It has formed at the base of slopes from materials derived mostly from uplands underlain by red shale. The materials were washed mainly from Teas soils; but materials from other soils, such as Litz, Elliber, and Ramsey, are included in many places. This soil differs from Camp silt loam mainly in having distinct surface soil and subsoil layers and in having a finer textured lighter colored subsoil. It is also on stronger slopes and is moderately susceptible to erosion, whereas the Camp soil receives rather than loses material. Practically all of Shouns silt loam, eroded rolling phase, is moderately eroded, and a notable part of the original surface soil has been lost. There has been considerable mixing of the surface soil and subsoil in the plow layer, and in a few places the subsoil is exposed. The present surface layer varies from dusky red to reddish brown or yellowish brown and from silt loam to silty clay loam. This soil is in relatively small individual areas widely distributed in the valleys of Laurel, Roan, and Doe Creeks and is closely associated with Teas, Litz, and Camp soils.

Profile description:

0 to 10 inches, dusky-red to reddish-brown friable silt loam; weak medium crumb structure; in wooded areas the surface 2 inches is stained dark grayish brown with organic matter.

10 to 32 inches, strong-brown to yellowish-brown friable to firm silty clay loam or silty clay; moderate medium blocky structure.

32 to 48 inches +, yellowish-brown to brownish-yellow friable silty clay or heavy silty clay loam; many red and yellow partially weathered shale fragments in the lower part of this layer.

The soil is medium to strongly acid throughout; it is moderately well supplied with organic matter and most plant nutrients. Both runoff and internal drainage are medium. Water is absorbed moderately fast and is well retained. The water-supplying capacity is high. The soil is relatively stone-free but in places there are quartzite cobbles 2 to 6 inches across that have rolled from the higher lying Ramsey soils. In areas closely associated with Elliber soils some chert fragments are on the surface. The soil is sufficiently permeable for good root penetration and adequate circulation of air and moisture.

A very small acreage that differs from the soil described only in being uneroded is included. A fairly large acreage is included that is predominantly from materials washed from Elliber soils. This inclusion is similar to Shouns silt loam, eroded rolling phase, in most profile characteristics except color, which is chiefly yellow rather than reddish in the surface soil. A few imperfectly drained seepage areas are also included.

Use suitability.—Practically all of this soil is cleared and used rather intensively for a wide variety of crops, including a comparatively large acreage of tobacco and beans. A very small acreage is in permanent pasture, but a considerable acreage is in rotation pasture. Very little of the soil is ever idle, but an appreciable part is in roads and homesteads.

The soil is well suited to all the crop and pasture plants commonly grown in the county. Good yields of tobacco, truck crops, corn, small grains, legumes, and grasses are obtained with only moderate fertilization. However, on this responsive soil high yields can be obtained and maintained by using crop rotations and amendments properly. In a rotation of moderate length that includes close-growing crops, erosion is not a serious problem. The soil is somewhat deficient in lime, nitrogen, and phosphate for most crops, and possibly in potash for the deep-rooted legumes. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Shouns silt loam, eroded hilly phase (12–25% slopes) (Se).—This is a well-drained soil on old colluvial foot slopes. The parent material has washed mainly from Teas soils, but it includes material from other soils, such as Litz, Elliber, and Ramsey. This soil differs from Shouns silt loam, eroded rolling phase, chiefly in having stronger slopes. Erosion has been somewhat more severe in most places, and the depth to bedrock is more variable and, on the average, more shallow.

The surface layer is a dusky-red to reddish-brown or yellowish-brown friable silt loam to silty clay loam that ranges considerably in thickness. The subsoil consists of strong-brown to yellowish-brown friable to firm silty clay loam or silty clay. In most places the colluvial deposit is 3 feet or more in thickness. Quartzite cobbles or chert fragments from the higher lying Ramsey or Elliber soils are on the surface in places. About 100 acres of soil included has formed from material predominantly from Elliber soils and is lighter colored than typical.

Use suitability.—All except a very few acres of this soil is cleared. It is being used for crops or pasture, but a significant acreage is idle each year. Much more of the soil is in pasture than of Shouns silt loam, eroded rolling phase.

The soil is fairly well suited to the common crops of the county, but there is a definite problem of conservation on areas used for intertilled crops. It is not so well suited to crops as the eroded rolling phase; the

stronger slopes result in more rapid runoff and an increased conservation problem and make the soil more difficult to work. Maintaining high yields will require longer rotations that include more close-growing crops and the proper use of amendments. The soil is deficient in nitrogen and phosphate for most crops, and possibly in lime and potash for the legume crops. Unless a fairly high level of management is followed, the soil is probably best used for pasture. For a discussion of use and management, see group 6 in the section on Use and Management of Soils.

Staser fine sandy loam (0–2% slopes) (Sg).—This is a brown well-drained sandy soil of the stream bottoms. The parent material consists of mixed general alluvium washed chiefly from Teas, Litz, and Ramsey soils. It includes quartzite, shale, siltstone, conglomerate, sandstone, and in some places dolomite material. The soil differs from Hamblen loam chiefly in being better drained and consequently free of mottlings to a greater depth. This soil is on nearly level flood plains in practically all parts of the county except in the extreme eastern part. It is closely associated with Hamblen, Sequatchie, Hayter, Shouns, Camp, and Jefferson soils.

Profile description:

0 to 14 inches, dark-brown or brown very friable to loose fine sandy loam.
14 to 24 inches, yellowish-brown or brown friable heavy loam to fine sandy loam.
24 inches +, brownish-yellow or pale-yellow sandy loam to loamy fine sand, mottled with gray below about 36 inches.

The soil is slightly acid in most places, but some included areas are medium to strongly acid. It is apparently moderately high in content of organic matter and most plant nutrients. Some gravel and cobbles are on the surface and throughout the profile but do not interfere materially with tillage. Roots penetrate the soil easily, and air and water circulate freely. Water is readily absorbed and fairly well retained. Runoff is slow but internal drainage is medium. Most of the soil is subject to overflow.

Use suitability.—Practically all of this soil has been cleared and cultivated. It is used chiefly for corn, which is grown in many places continuously. Hay crops are grown to some extent, and small grains and truck crops are produced on a small acreage.

This soil is well suited to intensive use for crop production. Flooding restricts its use suitability but also serves to maintain the fertility by deposition of material high in organic matter and plant nutrients. The soil is well suited to corn and many hay crops. Small grain crops tend to lodge and mature late, and are susceptible to disease on Staser fine sandy loam; but good yields are obtained in many places. Although the productivity is relatively high, increased yields can be expected from the application of phosphates and nitrogen and the use of a short rotation that includes a legume. For a discussion of use and management, see group 1 in the section on Use and Management of Soils.

Stony colluvium, Jefferson soil material (5–25% slopes) (Sh).—This extremely stony excessively drained miscellaneous land type occupies small alluvial or colluvial fans and sloping areas at the base of steep mountain slopes. The soil material has washed or rolled from Ramsey soils of the mountain uplands and is similar to that from which the Jefferson soils are formed. The colluvial material con-

tains sufficient stones or cobbles to prohibit practical tillage operations. The stones, numerous both on the surface and throughout the soil, are of various sizes, and may range up to several feet across. Some are somewhat rounded; others are more or less angular. This land type is in small areas widely distributed in the mountainous section of the county. It is closely associated with Ramsey soils.

Use suitability.—This land type is physically unsuited to crop production and poorly suited to pastures. Fair pastures can be obtained, but the control of weeds is difficult. Much better pastures are obtained if adequate amounts of lime and phosphate are applied. For a discussion of use and management, see group 9 in the section on Use and Management of Soils.

Stony colluvium, Tusquitee soil material (5–25% slopes) (Sk).—This is extremely stony excessively drained colluvium or local alluvium that has washed or rolled from Ashe or Porters soils. It occurs on small alluvial or colluvial fans and sloping areas at the base of steep mountain slopes. The soil material is similar to that of the Tusquitee soils. It contains sufficient stones to prohibit practical tillage operations. The stones, numerous throughout the profile, vary from 2 to 20 inches or more in size but are mostly 2 to 10 inches across. They are mainly subangular but some are somewhat rounded. Areas of this miscellaneous land type are small and widely distributed in the Ashe-Tusquitee-Perkinsville and Porters-Tusquitee-Clifton soil associations.

Use suitability.—This land type is unsuited to crop production and poorly suited to pasture. Fair pastures can be obtained, but the control of weeds is very difficult. Better pastures, free of weeds, are obtained if adequate lime and phosphate are applied. For a discussion of use and management, see group 9 in the section on Use and Management of Soils.

Stony rough land, Ashe and Porters soil materials (25–60+% slopes) (Sl).—This excessively drained miscellaneous land type is on steep and rocky slopes of practically all mountains underlain by granite, gneiss, and schist. It is characterized by ledges and outcroppings of granitic rocks. Outcrops and boulders occupy 20 to 70 percent of the surface; the Porters or Ashe soil material that occupies the space between them ranges from a few inches to about 3 feet in depth.

Use suitability.—This land type is almost entirely in forest that is dominantly hardwoods with scattered areas of hemlock and pine. It is best suited to this use. A part of it is within the Cherokee National Forest. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Stony rough land, Elliber and Teas soil materials (25–60+% slopes) (Sm).—This excessively drained miscellaneous land type is locally known as rock land. It is characterized by numerous ledges and outcroppings of limestone or shale, which occupy from 20 to 70 percent of the surface. It occurs in small areas widely distributed in the valleys of Laurel, Roan, and Doe Creeks. The soil material covering the rocks and occupying the spaces between the ledges and outcroppings is shallow (from a few inches to about 3 feet deep). The soil material ranges from brownish yellow or reddish brown to weak red.

Use suitability.—More than 80 percent of this land type is estimated to be in forest, much of which consists of a sparse growth of drought-resistant species. Under prevailing conditions it is best used for forest. Stoniness largely precludes its use for crops or pasture, although the less stony, less sloping areas support fair pastures, especially early in spring. Control of weeds and brush is extremely difficult in the cleared areas. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Stony rough land, Ramsey soil material (25–60+% slopes) (SN).—This excessively drained miscellaneous land type occurs on steep and rocky slopes throughout the Ramsey soil association. It is characterized by numerous bedrock outcrops and loose boulders (pl. 9, *A*). They occupy 20 to 70 percent of the surface in most places. The rocks consist of quartzite, fine-grained sandstone, and sandy and argillaceous shale. Ramsey soil material occupies the space between the rocks and boulders. It ranges from a few inches to 2 or 3 feet deep in most places and is highly variable in texture and color.

Use suitability.—The land type is almost entirely in forest, dominantly hardwoods with scattered areas of hemlock and pine, and is best suited to this use. A large part lies within the present boundaries of the Cherokee National Forest. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Teas shaly silt loam, steep phase (25–60% slopes) (TK).—This is a reddish excessively drained to well drained soil of the uplands. The parent material was weathered from red shale interbedded with some thin lenses of dolomite. The shale is calcareous in some places. The soil occupies characteristically rounded or domelike hills and is widely distributed in the Teas-Litz-Shouns-Camp soil association. It is closely associated with Litz, Camp, Hayter, Jefferson, Elliber, and Hagerstown soils.

Profile description:

0 to 8 inches, weak-red to dusky-red friable silt loam or shaly silt loam; in wooded areas the surface inch or so is stained dark with organic matter.

8 to 16 inches, light reddish-brown to reddish-brown friable shaly silty clay loam or heavy silt loam; moderate medium to coarse blocky structure.

16 inches +, weak-red or dusky-red friable shaly silty clay loam containing numerous partially decomposed shale fragments; bedrock at depths of 2 to 4 feet in most places.

This soil is slightly acid to strongly acid. In most places the surface soil is strongly acid, the subsoil medium acid, and the underlying material slightly acid. The content of organic matter appears to be relatively low, and that of many plant nutrients, especially phosphorus, is low. Some flaggy shale fragments are on the surface and throughout the soil but do not interfere materially with tillage. Some chert fragments or jasperoids, 2 to 6 inches across, are on the surface in many places. An occasional bedrock outcrop occurs. Runoff is very rapid and internal drainage is medium. The water-holding capacity is low, chiefly because of the shallow depth to bedrock.

Use suitability.—All of this soil is in forest, but it is considered suitable for pasture production. Owing to the steep slopes, low fertility, low water-holding capacity, and extreme susceptibility to erosion, it is poorly to very poorly suited to crop production. Fair pastures can be established and maintained, however, if adequate lime and phosphate

are used. The soil is highly deficient in phosphorus, but only slightly deficient in lime for high yields of pasture. The supply of potash is apparently adequate for most crops. Since the soil is highly susceptible to erosion when cleared, it is advisable to establish the pasture sod as soon as possible after clearing the land. Many areas of this soil are not suited to pasture because of relative inaccessibility. On many farms, the soil is probably best left in forest. For a discussion of use and management, see group 12 in the section on Use and Management of Soils.

Teas shaly silty clay loam, eroded steep phase (25–60% slopes) (TH).—This reddish excessively drained soil of the uplands is derived from materials weathered from red shale or red shale interbedded with some dolomite. It differs from Teas shaly silt loam, steep phase, in being eroded and in having silty clay loam texture in the surface soil. The soil is moderately eroded; about 25 to 75 percent of the original surface soil has been removed. In a few areas all the original surface soil has been lost and the subsoil is exposed. This soil also differs from the steep phase of Teas shaly silt loam in being shallower, in having less distinct surface soil and subsoil layers, and in having more bedrock outcrops. It is widely distributed in the Teas-Litz-Shouns-Camp soil association.

Use suitability.—All of this soil has been cleared and used for crops and pasture. At present most of it is used for pasture and hay; however, some is used for intertilled crops and a considerable part is idle. Part of the idle soil is reverting to forest.

This soil is very poorly suited to crops and poorly suited to pasture. It is low in fertility, low in water-holding capacity, steep, and highly susceptible to erosion. Because of the shallow depth to bedrock, it is susceptible to great injury from further erosion. On most farms it is probably best used for forest; but if additional pasture is needed, it can presumably be maintained under a high level of management. For a discussion of use and management, see group 12 in the section on Use and Management of Soils.

Teas shaly silty clay loam, eroded hilly phase (12–25% slopes) (TG).—This is a reddish excessively drained to well drained soil of the uplands. It has formed from materials weathered from red shale and some dolomite. The soil differs from Teas shaly silt loam, steep phase, chiefly in being eroded and in having milder slopes. About 25 to 75 percent of the original surface soil has been removed by accelerated erosion. In places all the surface soil has been lost and the subsoil is exposed. As a result of the mixing of the remnants of the original surface soil with the subsoil, in the plow layer, the present surface layer is significantly heavier and more variable in thickness and color. The soil is in the Teas-Litz-Shouns-Camp soil association.

The present surface layer is 3 to 7 inches thick and consists of weak-red to dusky-red friable shaly silty clay loam. The subsoil is a light reddish-brown to reddish-brown friable shaly silty clay loam.

Use suitability.—All except a very small acreage of this soil is cleared and used for crops and pasture. At present most of the acreage is used for hay crops and pasture, but some is used for intertilled crops and a small part is idle. Some hay crops and pasture receive applications of lime and phosphate, but this practice is not common.

This soil is considered better suited to permanent pasture than to crops that require tillage. It is highly susceptible to erosion, low in fertility and water-holding capacity, and low in productivity for most crops. With the proper use of lime and phosphate, fair to good pastures can be established and maintained. Careful control of grazing is needed, however, to maintain a good sod. For a discussion of use and management, see group 12 in the section on Use and Management of Soils.

Teas-Litz silt loams, hilly phases (12–25% slopes) (TE).—This is a complex comprised of two soils (Teas silt loam, hilly phase, and Litz silt loam, hilly phase) so intricately associated geographically that it is not practical to delineate them separately on the soil map. It is estimated that the Teas soil makes up 60 percent of the area, and the Litz soil 40 percent. These are excessively drained to well drained soils of the uplands derived from materials weathered from shale or interbedded shale and dolomite. The shale underlying the Teas soil is red, and that underlying the Litz soil is chiefly green. These soils are on rounded or dome-shaped hills in the valleys of Roan, Laurel, and Doe Creeks. They are closely associated with Camp, Jefferson, Hayter, Elliber, and Ramsey soils.

Profile descriptions:

Teas silt loam, hilly phase:

0 to 8 inches, weak-red or dusky-red friable silt loam; in wooded areas the 1-inch surface layer is stained dark with organic matter.
8 to 20 inches, light reddish-brown to reddish-brown friable shaly silty clay loam.
20 inches +, weak-red friable shaly heavy silt loam; bedrock, which is at depths of 2 to 4 feet, consists of red shale interbedded with dolomite; the shale is calcareous in places.

Litz silt loam, hilly phase:

0 to 8 inches, light yellowish-brown friable silt loam; in wooded areas the surface layer, about 1 inch thick, is stained gray with organic matter.
8 to 20 inches, brownish-yellow to yellow friable shaly silty clay loam faintly mottled with gray and yellow.
20 inches +, shaly silty clay loam to silty clay, highly mottled with red, brown, yellow, and gray; bedrock, which is at depths of 2 to 4 feet, consists of light-colored shale interbedded with thin lenses of dolomite.

In most places the soils in this complex range from slightly to strongly acid. In a few small areas, the soils are neutral, especially where partially weathered calcareous shale fragments occur throughout the soil. In many places the surface soil is strongly acid, the subsoil medium acid, and the underlying material slightly acid. The content of organic matter appears to be moderately low, and that of many plant nutrients, especially phosphorus, is low. Some flaggy shale fragments are on the surface and throughout the soils, but not in quantities sufficient to interfere materially with tillage. Some chert fragments or jasperoids are on the surface in many places. Runoff is rapid to very rapid and internal drainage is medium. The water-holding capacity of these soils is low, chiefly because of the relatively shallow depth to bedrock.

Use suitability.—The soils of this complex are almost entirely in forest. They are not considered suitable for intertilled crops, mainly because of the low fertility, low water-holding capacity, and strong slopes. They are suitable for pasture, but many of the areas are asso-

ciated with soils not suited to such use. Consequently, on many farms they are probably best used for forest. Since cleared areas are highly susceptible to erosion, it is advisable to establish pasture sod as soon as possible after removing the forest. Lime and phosphate are required to establish and maintain good pastures. For a discussion of use and management, see group 12 in the section on Use and Management of Soils.

Teas-Litz shaly silty clay loams, eroded hilly phases (12–25% slopes) (TA).—This is a complex association of Teas shaly silty clay loam, eroded hilly phase, and Litz shaly silty clay loam, eroded hilly phase. It is estimated that Teas soil is on about 60 percent and Litz soil on about 40 percent of the area. These soils are excessively drained to well drained and have formed from materials weathered from interbedded shale and dolomite. The soils of this complex differ from those of Teas-Litz silt loams, hilly phases, chiefly in being eroded. A considerable part of the original surface layer has been lost, and the remaining part has been mixed in the plow layer with some of the subsoil. As a result of this mixing, the present surface layer is significantly heavier in texture and more variable in color and thickness. In many small spots, all the original surface layer is missing and the subsoil is exposed. With the loss of the finer materials, there has been an accumulation of fine shale fragments in the surface layer, but they do not seriously interfere with tillage. This complex of soils is widely distributed in the valleys of Laurel, Roan, and Doe Creeks. It is closely associated with Camp, Jefferson, Hayter, Ramsey, and Elliber soils.

Use suitability.—The soils of this complex have been almost entirely cleared and used for crops and pasture. A variety of crops, including corn, small grains, legumes and grasses, and some tobacco and truck crops are grown. No regular system of crop rotation prevails, and fertilization is generally not adequate to produce high yields. Both crop and pasture yields are moderately low under the prevailing systems of management.

These soils are considered better suited to permanent pasture than to crops, although they presumably can be maintained under a high level of management. Rotations would need to be long and consist chiefly of close-growing crops, preferably deep-rooted legumes and grasses. Adequate fertilization and contour tillage would also be necessary to increase or maintain productivity. However, good pastures can be rather easily established and maintained (pl. 9, *B*). Applications of lime and phosphate will be needed in most places. For a discussion of use and management, see group 12 in the section on Use and Management of Soils.

Teas-Litz silt loams, steep phases (25–60% slopes) (TF).—This complex consists of areas of Teas silt loam, steep phase, and Litz silt loam, steep phase, that are intricately associated geographically. The soils are excessively drained. They have formed from materials weathered from interbedded shale and dolomite. They differ from the complex of Teas-Litz silt loams, hilly phases, chiefly in having steeper slopes. They further differ in being shallower, in having even less distinct surface soil and subsoil layers, and in having more shale fragments on the surface and throughout the profile. An occasional bedrock outcrop occurs. This complex of soils is widely distributed

throughout the Teas-Litz-Shouns-Camp soil association. It is closely associated with Ramsey, Hayter, Jefferson, Elliber, and Hagerstown soils.

Use suitability.—All of this complex of soils is in forest consisting predominantly of hardwood but also including some white pine and hemlock. The soils are very poor for crops and poor for pasture. Forest is presumably their best use on most farms. The soils are low in fertility, low in water-holding capacity, and very susceptible to erosion when cleared. For a discussion of use and management, see group 12 in the section on Use and Management of Soils.

Teas-Litz shaly silty clay loams, eroded steep phases (25–60% slopes) (Tc).—This complex consists of an intricate association of Teas shaly silty clay loam, eroded steep phase, and Litz shaly silty clay loam, eroded steep phase. These soils are excessively drained. They differ from the Teas-Litz silt loams, hilly phases, chiefly in having steeper slopes and in being eroded—a considerable part of the original surface layers has been lost. Because of incorporation of subsoil material, the surface layers have a significantly heavier texture and a more variable color and thickness. The finer soil materials have been removed, and the shale fragments have accumulated in the surface layers. In general these soils are also shallower and have more bedrock outcrops than Teas-Litz silt loams, hilly phases. This complex of soils is widely distributed in the valleys of Laurel, Roan, and Doe Creeks.

Use suitability.—All of this complex has been cleared and used for crops and pasture. Most of it is now in pasture, some is used for crops, and a considerable part is idle. A part of the idle soil is reverting to forest. Crop and pasture yields are generally low.

Owing to steepness, shallow depth, low fertility, low water-holding capacity, and susceptibility to erosion, the soils of this complex are very poorly suited to crop production and poorly suited to pasture. On many farms they probably should be allowed to revert to forest. The need for pastureland, however, may make it advisable to use some areas for pasture. If grazing is carefully controlled, fair to good pastures can be established and maintained, provided lime and phosphate are applied in adequate quantities. For a discussion of use and management, see group 12 in the section on Use and Management of Soils.

Teas-Litz shaly silt loams, very steep phases (60+% slopes) (Td).—This complex consists of an intricate association of Teas shaly silt loam, very steep phase, and Litz shaly silt loam, very steep phase. These soils are excessively drained. They differ from those of Teas-Litz silt loams, hilly phases, chiefly in having much steeper slopes. They are also shallower in most places, and bedrock outcrops are much more common. Small partially weathered shale fragments are more numerous on the surface and throughout the profiles. Most of this complex of soils is in the Teas-Litz-Shouns-Camp soil association.

Use suitability.—Practically all of this complex is in forest, predominantly hardwood with some white pine and hemlock. This is considered its best use. The very steep slopes practically prohibit use for either crops or pasture. For a discussion of use and management, see group 14 in the section on Use and Management of Soils.

Teas-Litz shaly silty clay loams, eroded rolling phases (5–12% slopes) (TB).—This is a complex association of Teas shaly silty clay loam, eroded rolling phase, and Litz shaly silty clay loam, eroded rolling phase. Both soils are well drained to excessively drained. It is estimated that the Teas soil makes up about one-half of the area, and the Litz soil the other half. These soils have formed from materials weathered from a shale that is interbedded with thin lenses of dolomite. They differ from Teas-Litz silt loams, hilly phases, chiefly in being eroded and in having milder slopes. In addition, in most places, they have greater depth to bedrock, more distinct surface soil and subsoil layers, and fewer shale fragments on the surface and throughout the profile.

A considerable part (25 to 60 percent) of the original surface layer has been lost through erosion. The remnants of the surface layer have been mixed with subsoil material, and the result is a plow layer significantly heavier in texture and more variable in thickness and color than the original surface soil.

This complex of soils is chiefly on ridge crests. It is widely distributed in small areas throughout the Teas-Litz-Shouns-Camp soil association. It is closely associated with Camp, Hayter, Jefferson, Ramsey, Elliber, and Hagerstown soils.

Use suitability.—It is estimated that 90 percent of this complex of soils has been cleared and used for crops and pasture. A large number of crops are grown, including corn, small grains, legumes and grasses, and some truck crops and tobacco. Crops commonly are not rotated systematically, but a few farmers follow a 4-year rotation of corn, small grain, clover, and grass.

These soils are moderately well suited to both crops and pasture. They are generally more acid than the hilly and steep phases, and liming is necessary for many crops, especially the deep-rooted legumes. They are deficient in phosphate and nitrogen for high yields of most crops, and may be slightly deficient in potash for some. The moderately low water-holding capacity can be expected to limit the response of crops susceptible to drought or of crops that mature in the dry summer and fall months. Chiefly for this reason, the small grains produce proportionately higher yields than corn. The soils are moderately susceptible to further erosion, which would cause great injury. For a discussion of use and management, see group 12 in the section on Use and Management of Soils.

Tusquitee loam, eroded rolling phase (5–12% slopes) (TM).—This is a brown well-drained soil of the colluvial lands. The colluvium or local alluvium from which the soil formed has washed or rolled from uplands underlain chiefly by granite, gneiss, and schist. The wash comes mainly from Porters and Ashe soils (pl. 10, *A*). Most of this soil is moderately eroded. In most places 25 to 50 percent of the original surface soil, including the layer of higher organic-matter content, has been lost. This phase occurs in small areas at the base of upland slopes and is closely associated with Congaree, Chewacla, Porters, Ashe, and Clifton soils. It is widely distributed in the eastern part of the county, chiefly in the Porters-Tusquitee-Clifton and Ashe-Tusquitee-Perkinsville soil association areas.

Profile description:

0 to 12 inches, brown to dark-brown friable loam or silt loam with a strong medium to coarse crumb structure; in wooded areas the upper 3 or 4 inches is a dark-brown or dark grayish-brown loose loam, high in organic matter.
12 to 36 inches, yellowish-brown to brown or strong-brown friable light silty clay loam to clay loam with a weak fine blocky structure.
36 to 48 inches +, strong-brown to yellowish-brown friable clay loam, faintly mottled with gray in some places; the colluvial deposit ranges from about 2 to 10 feet or more in thickness.

The soil is medium to strongly acid and apparently relatively high in organic matter. It is moderately well supplied with plant nutrients. Both runoff and internal drainage are medium. Rainfall is readily absorbed and well retained. A few stones, 2 to 10 inches across, are on the surface and throughout the profile in many places, but they do not interfere materially with tillage. Variable amounts of mica flakes occur throughout the profile. The soil is very permeable to air, roots, and water.

Some areas of soil included are much lighter colored than the soil described. They have brownish-gray surface soils and brownish-yellow subsoils. These areas are generally less well drained, mainly because of seepage. Some areas have received recent deposits of colluvial material and have less distinct surface soils and subsoils.

Use suitability.—Practically all of this soil has been cleared and cultivated. Most of it is used rather intensively for crop production, but some is in pasture, and an appreciable acreage is in roads, homesteads, and other nonfarm uses. Systematic crop rotation is not commonly practiced, although a number of different crops are grown. A fairly high proportion of the soil is used for truck crops and tobacco, but corn, small grains, legumes, and grasses are important crops.

This soil is very well suited to the production of crops and pasture. Although naturally one of the more productive soils of the county, it still responds well to good management. Good tilth is easily maintained, and the soil can be tilled over a fairly wide range of moisture conditions. Although the soil areas are generally small and irregularly shaped, all types of farm machinery can be used. The soil is somewhat susceptible to erosion; but under good management, erosion control is not a serious problem. Lime and phosphate are deficient for continued high yields of most crops, and applications are necessary for the successful growth of crops such as red clover and alfalfa. Nitrogen is also deficient for all except legume crops. Potash is not generally deficient. For a discussion of use and management, see group 3 in the section on Use and Management of Soils.

Tusquitee loam, eroded hilly phase (12–25% slopes) (TL).—This is a brown well-drained soil of the colluvial lands. It has formed at the base of steep mountain slopes from colluvium or local alluvium similar to that from which the eroded rolling phase has formed. It differs from the eroded rolling phase, chiefly in being more eroded and in having a stronger slope. In most places the colluvial deposit averages somewhat shallower and the soil is more variable in characteristics. This soil is widely distributed throughout the Porters-Tusquitee-Clifton and Ashe-Tusquitee-Perkinsville soil associations.

The present surface soil ranges from 4 to 10 inches in thickness and is a brown to yellowish-brown friable loam. The subsoil is a yellowish-brown to strong brown friable clay loam. A part of the

original surface layer, including the layer of higher organic-matter content, has been lost as a result of erosion.

Use suitability.—Practically all of this soil has been cleared and cultivated. The present use is similar, but not quite so intensive as that for the eroded rolling phase of Tusquitee loam. Crop yields are appreciably lower.

Owing to the hilly relief, this soil is only moderately well suited to crop production. On most farms it is probably better suited to pasture or semipermanent hay crops. Very good pastures can be established and maintained under a management system that includes adequate applications of lime and phosphate. The soil is similar to Tusquitee loam, eroded rolling phase, in use and management requirements but is more exacting in the choice and rotation of crops, fertilization, tillage practices, and water-control practices. Longer rotations, heavier fertilization, contour tillage, and possibly strip-cropping are necessary to maintain or increase crop yields. For a discussion of use and management, see group 6 in the section on Use and Management of Soils.

Tusquitee stony loam, eroded rolling phase (5–12% slopes) (To).—This is a brown well-drained stony soil of the colluvial lands. It has formed at the base of steep mountain slopes from colluvial or local alluvial material derived chiefly from granite, gneiss, or schist that washed or rolled mainly from Porters and Ashe soils. In most places a considerable part of the original surface layer, including that of higher organic-matter content, has been lost as a result of erosion. The present surface layer is variable in thickness and color and is somewhat heavier textured in the more eroded spots. This soil differs from Tusquitee loam, eroded rolling phase, chiefly in being stony. It is widely distributed in the Porters-Tusquitee-Clifton and Ashe-Tusquitee-Perkinsville soil association areas. It is closely associated with Congaree, Chewacla, Clifton, Porters, Ashe, and other Tusquitee soils.

Profile description:

0 to 10 inches, brown friable stony loam.
10 to 32 inches, yellowish-brown or strong-brown friable stony clay loam.
32 inches +, strong-brown to brownish-yellow friable stony clay loam, mottled with gray in some places; depth of the colluvial deposit ranges from 2 to 10 feet.

This soil is medium to strongly acid and apparently is relatively high in organic matter. It is also moderately well supplied with plant nutrients. Runoff and internal drainage are medium. Numerous stones, up to 10 inches across, are on the surface and throughout the soil mass in quantities sufficient to interfere materially with and, in some places, almost to prohibit tillage. The soil is very permeable to air, roots, and water. Water is moderately well retained.

Some small included areas are less well drained than the soil described and are lighter colored throughout the profile. These imperfectly drained areas are largely the result of seepage.

Use suitability.—Practically all of this soil is cleared. Most of the cleared areas are in crops, but some are used for pasture and an appreciable number are idle. Fair crop and pasture yields are obtained without the use of amendments.

This soil is physically suitable for the production of crops; but owing to stoniness, it is much less desirable for crop production than

Tusquitee loam, eroded rolling phase. Use and management requirements are the same as for that soil, but crop and pasture yields will average lower. For a discussion of use and management, see group 4 in this section on Use and Management of Soils.

Tusquitee stony loam, eroded hilly phase (12–25% slopes) (TN).—This is a brown well-drained stony soil of the colluvial lands. It has formed at the base of steep mountain slopes from colluvium on local alluvium derived from uplands underlain by granite, gneiss, and schist. It has come mainly from Porters and Ashe soils. This soil differs from Tusquitee loam, eroded rolling phase, chiefly in having stronger slopes. Most areas are moderately eroded and have lost about 25 to 60 percent of the original surface soil. The soil is widely distributed in the Porters-Tusquitee-Clifton and Ashe-Tusquitee-Perkinsville soil association areas.

The soil has a brown stony loam surface soil and a yellowish-brown or strong-brown clay loam subsoil. Some areas included are less well drained than the soil described, and are lighter colored throughout the profile. The surface soil and subsoil layers are less distinct in areas that continue to receive colluvial material.

Use suitability.—Practically all of this soil has been cleared and used for crops or pasture. Most of the cleared area is now in pasture, but some is in crops and a considerable part is idle. Fair pastures are obtained under the prevailing management practices.

This soil is poorly suited to crops, but is fairly well suited to pasture. The combination of hilly slopes and stoniness makes the soil difficult to till and also interferes materially with weed control in the pastures. Stones are so numerous in some areas that they almost prohibit tillage. The soil is moderately fertile, and fair pastures are obtained without amendments. A fair to good response can be expected from the use of lime and phosphate. With adequate fertilization and carefully controlled grazing, good pastures can be established. For a discussion of use and management, see group 9 in the section on Use and Management of Soils.

Tyler silt loam (0–2% slopes) (TP).—This is a gray somewhat poorly drained soil on nearly level or depressional stream terraces. The alluvium from which the soil is derived came from uplands underlain by quartzite, shale, siltstone, conglomerate, sandstone, and some dolomite. The soil consists of material washed mainly from Teas, Litz, Ramsey, and Matney soils. Some material from other soils, such as Elliber, Hagerstown, Hayter, and Jefferson, is also included in the parent material in most places. The soil generally occupies a position adjacent to upland slopes and is saturated a large part of the time by seepage from these slopes. It is closely associated with Whitwell soil and differs chiefly in being more poorly drained. Runoff is slow or very slow and internal drainage is very slow. The native vegetation consisted mainly of water-tolerant trees. This soil is widely distributed in the county but occurs mainly along Roan, Doe, and Goose Creeks in association with the Sequatchie and Whitwell soils.

Profile description:

0 to 10 inches, gray friable silt loam.
10 to 17 inches, pale-yellow friable silty clay loam mottled with gray.
17 to 48 inches +, compact silty clay or claypan layer highly mottled yellow and gray; in most places less compact below about 40 inches.

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Tyler silt loam is strongly to very strongly acid, low in organic matter, and low in natural productivity. The compact claypan layer is relatively impermeable to air, roots, and water, and the layers above the claypan are saturated with water a large part of the year. The soil has a low water-supplying capacity, however, and crops are injured by extended wet or dry seasons. Although most areas are somewhat poorly drained, a few are poorly drained and gray or mottled with gray throughout, resembling the Purdy [7] soils.

Use suitability.—Most of Tyler silt loam is used for permanent pasture or is in forest. Corn, hay, and sorghum are grown on a few areas, but yields are low. The pasture vegetation consists mainly of water-tolerant species. Artificial drainage has been attempted in places by use of bedding and open ditches.

In its present condition, this soil is probably best suited to pasture and hay crops; although several summer crops, such as corn, sorghum, and soybeans, are grown with varying degrees of success. Artificial drainage can be expected to broaden the use suitability and increase the average yields of crops now grown, but the soil is difficult to drain adequately. Tile drainage cannot be expected to be effective, because of the compact layer in the subsoil. Open ditches, bedding, and row direction and diversion ditches or terraces on the adjacent soils would be effective in removing surface water in many places. The lime and fertilizer requirements are high, but response to amendments may be less than on the associated soils because of the unfavorable moisture conditions and limited rooting zone. Nevertheless, pastures and hay crops can be improved by the use of lime and phosphorus and possibly potash. For a discussion of use and management, see group 11 in the section on Use and Management of Soils.

Whitwell silt loam (2–5% slopes) (WA).—This is an imperfectly drained soil of the low stream terraces. The alluvium from which the soil is derived washed from uplands underlain by a wide variety of rocks, including quartzite, shale, siltstone, conglomerate, sandstone, and some dolomite. The material from shale is apparently predominant. The alluvial materials were washed mainly from Ramsey, Matney, Teas, and Litz soils. The soil is underlain by limestone or calcareous shale at a depth of 5 feet or more. It occurs along many of the larger creeks, but most of it is along Beaverdam Creek in Shady Valley. It generally occupies a somewhat lower position than the associated Sequatchie soils and is closely associated with Sequatchie, Hamblen, Prader, and Dunning soils.

Profile description:

0 to 8 inches, brown friable silt loam.
8 to 16 inches, brownish-yellow to yellowish-brown friable heavy silt loam.
16 to 30 inches, brownish-yellow friable silty clay loam mottled with yellow, light gray, and strong brown.
30 inches +, friable silty clay loam mottled with gray, yellow, and strong brown.

The soil is slightly to medium acid and apparently moderately well supplied with plant nutrients and organic matter. The water table is within 2 or 3 feet or less of the surface a considerable part of the year; consequently, the root zone is limited and the soil is poorly aerated during part of the growing season. The water-supplying capacity is high.

[7] The Purdy soils are not mapped in Johnson County.

Use suitability.—Practically all of this soil is cleared and used for crops or pasture. The common crops are corn, oats, beans, red clover, and timothy. Pastures are mainly the rotation type.

The soil is not suited to so many crops as the Sequatchie soils, mainly because of its imperfect drainage. It is well suited to corn and many hay crops including red clover, but it is not well suited to alfalfa and is less well suited to tobacco and truck crops than the Sequatchie soils. Artificial drainage would be expected to broaden the use suitability, however. The soil is suited to intensive use if the organic matter and fertility levels are maintained by using crop residues, green manure, barnyard manure, and commercial fertilizers. It is deficient in phosphorus and potash for continued high yields, but the lime content is generally adequate for all except the red clover crop. For a discussion of use and management, see group 2 in the section on Use and Management of Soils.

USE AND MANAGEMENT[8] OF SOILS

The better farmers of Johnson County are interested in using and managing their soils so that the best growing conditions for crops are obtained for an indefinite period at a minimum cost. That is, they are interested in the highest practical yields that can be maintained. Many of the farmers are now practicing good soil management, and their crop yields are much higher than the county average. In general, these farmers are following such basic management (*5*) as:

1. The use of good crop varieties that are adapted to the county.
2. The use of a suitable rotation—one that makes the best use of the water on the land. Generally this will include (a) a legume for nitrogen maintenance, (b) a tilled crop for weed control, (c) a deep-rooted crop to obtain subsoil nutrients and to increase permeability, and (d) pasture, meadow, or green manure to maintain organic matter and good tilth.
3. Return of barnyard or green manure to the soil in order to maintain a supply of nitrogen and fresh organic matter.
4. Application of limestone, phosphate, nitrogen, or potash, or any combination of these materials, where needed. (See county agent about testing soil before lime or fertilizer is added.)
5. Practice of reasonable care in preparing the seedbed and following the better practices for time and rate of planting.
6. Practice of suitable measures for controlling weeds, insects, and diseases.

Although these basic practices will apply to all the soils of the county, the soil mapping units do differ in varying degrees in their use suitability and management requirements. In order to abbreviate and simplify the discussion of use and management, however, the soils similar in those characteristics particularly important in their management are discussed together in this section.[9] The soils within each

[8] The term "soil use" refers to broad farm uses such as (1) for crops that require tillage, (2) for permanent pasture, and (3) for forests. The term "soil management" refers to (1) choice and rotation of crops, (2) application of soil amendments, such as lime, commercial fertilizers, manure, and crop residues, (3) tillage practices, and (4) engineering practices for the control of water on the soil.

[9] It is recognized that some of the suggestions for management practices for the various soils may not be feasible for all farmers in the county under present conditions. Each farm has circumstances peculiar to itself. Some of these circumstances may dictate combinations of management practices different from those indicated in this section but better suited to the particular conditions of the farm.

group may be similar or they may vary both in productivity for certain crops and in response to improved management practices. All the soils in one group have the same color on the map.

Present use and management and suggested management are discussed for each group of soils. Tables list for each soil of each management group expected average acre yields of principal crops and pasture [10] under two levels of management.

The yields in columns A of these tables are to be expected under the present management. Yields in columns B are to be expected under the suggested management, which is the higher level of management practiced by a few of the better farmers and thought to be feasible under present economic conditions. Since the crop yields are averages based on at least a 5-year period, yields higher than those given for the high level of management (columns B) are not uncommon and can be obtained in favorable seasons, especially if heavier fertilization than is now thought to be feasible is practiced. Also, expected yields may greatly change in the future as new crop varieties and cultural practices are introduced, or as new plant diseases or insect pests appear. To raise the yields from those given in columns A to those in columns B will generally require at least two rotation cycles under the high level of management.

For most groups, management requirements for both permanent pasture and crops requiring tillage are discussed. In each group, management for pasture is similar, but each management group has management requirements for tilled crops that distinguish it from the other groups. A discussion of each of the 14 management groups follows.

MANAGEMENT GROUP 1.—NEARLY LEVEL WELL-DRAINED TO IMPERFECTLY DRAINED SOILS OF THE BOTTOM LANDS

Management group 1 is made up of good to excellent crop and pasture soils. All are fertile and produce comparatively high yields of adapted crops without the use of amendments. They are well supplied with lime, organic matter, and plant nutrients and are replenished periodically by additions of fresh sediments. Moisture conditions are favorable most of the time for the growth of adapted plants. Practically all of the soils of group 1 have favorable tilth, which is easily maintained. All contain some chert, gravel, or shale fragments, but only Chewacla gravelly fine sandy loam has enough to interfere materially with tillage. Table 6 lists the soils of management group 1 and the yields of principal crops that can be expected from each under two levels of management.

These soils are well suited to intensive use for crop production, but their use suitability is limited to some extent by susceptibility to periodic flooding. Some of the soils are further limited by imperfect drainage. All are very well suited to corn and the summer annual

[10] Pasture yields are expressed in cow-acre-days. This term is used to indicate the carrying capacity of pasture land; it is the product of the number of animal units (a mature cow or steer) carried per acre multiplied by the number of days during the year the animals are grazed without injury to the pasture; for example, a soil that supports 1 animal unit per acre for 360 days rates 360; a soil supporting 1 animal unit on 2 acres for 180 days rates 90; and a soil supporting 1 animal unit on 4 acres for 100 days rates 25.

TABLE 6.—*Soils of management group 1: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under the suggested management. Blank spaces indicate crop is not commonly grown and soil is unsuited to its production under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Chewacla loam	35	60	----	(2)	--	(2)	1. 3	1. 6	------	(2)	100	210	-----	-------	90	135
Chewacla gravelly fine sandy loam	25	40	----	(2)	----	(2)	1. 1	1. 4	------	(2)	85	180	-------	-------	60	115
Congaree fine sandy loam	40	65	14	18	30	40	1. 2	1. 6	1. 4	1. 8	125	225	1, 400	1, 800	100	140
Hamblen loam	45	60	----	(2)	----	(2)	. 9	1. 6	------	(2)	100	210	-------	(2)	110	140
Staser fine sandy loam	45	65	14	18	30	40	1. 2	1. 6	1. 3	1. 7	125	225	1, 350	1, 725	105	145

[1] See footnote 10 in the text for definition of this term.

[2] Crop not commonly grown; soil considered suited to it, although less so than to crops for which yield predictions are given.

hay crops. They are poorly suited to alfalfa, although this crop is grown successfully in places. Red clover is apparently better suited. Small grains are generally more susceptible to lodging and disease and generally mature later than on soils of the uplands. Tobacco is well suited to the well-drained bottom soils, but it is rather poorly suited to the imperfectly drained bottom soils. Cabbage, snap beans, and many vegetable crops are very well suited to most of the soils, although the quality, especially of the beans, is lower than on Sequatchie and Hayter soils of group 2.

A. Present use and management.—All of the soils of group 1 are cleared and used rather intensively in the agriculture of the county. Corn, burley tobacco, vegetables, wheat, and hay are the chief crops. Red clover, alone or mixed with timothy or orchardgrass, is the chief hay crop. Very little alfalfa is grown, but lespedeza sown in small grains is used for hay or pasture on a considerable acreage. Tobacco and snap beans are the chief cash crops, but are grown less extensively on the soils of this group than on the associated terrace and colluvial soils.

A systematic rotation of crops is not ordinarily practiced on the soils of this group, although a corn or tobacco-small grain-hay rotation is used by a few farmers. The common practice is to break the sequence of row crops with a hay crop every few years. On a few farms the row crop is followed by a winter cover crop. Most farmers fertilize tobacco and bean crops heavily with a complete fertilizer, such as 3–9–6, 5–10–5, or 4–12–4. Beans generally receive 250 to 600 pounds and tobacco 800 to 1,200 pounds of fertilizer an acre, although a few farmers use as much as 2,000 pounds an acre. Many farmers also fertilize the corn and small grain crops, generally with light applications. Lime is commonly applied preceding the red clover or alfalfa, but the use of lime as well as fertilizers varies greatly from farm to farm in amount applied and frequency of application. Some farmers, however, apply as much as 2 or 3 tons at 3-year intervals. Tillage operations are carried out with reasonable promptness and care. Tile drainage is not common on the imperfectly drained soils, but open ditches have been used in many areas. Some insect- and disease-control measures are followed, but they are not adequate.

B. Suggested management.—The selection of adapted crops is very important for this group of soils. Although the adapted crops can be successfully grown almost continuously, a short rotation is desirable on most farms. A corn-hay rotation should be well suited, especially on the imperfectly drained soils. A corn-wheat-red clover rotation is successfully followed on the well-drained bottom soils on many farms. Growing winter legumes, such as crimson clover, and plowing them under as green manures in the spring should prove beneficial, especially where corn is grown every summer. Vegetable crops, such as cabbage or snap beans, could be substituted for the corn in the suggested rotations.

Although good crop yields are obtained without amendments, some fertilization is required to maintain high yields under intensive use. Moreover, response to fertilization is good because the soils have adequate water-supplying capacity for very high yields.[11] A good

[11] See the county agricultural agent for information regarding testing soils for available plant nutrients and for specific recommendations on kind and amount of fertilizer to be used.

response is expected from the liberal use of phosphate for practically all crops. A moderate application of potash may be needed for some crops, but this need will largely depend on the crop grown and the previous cropping system. Nitrogen fertilizers may be needed under continuous cropping, but a legume generally supplies enough for moderately high yields of all crops in the rotation. Lime and phosphate are generally required to establish and maintain red clover. Heavy applications of a complete fertilizer are generally practicable and desirable for such cash crops as tobacco and snap beans.

Special tillage or cropping practices for the maintenance of tilth or for water control are not generally necessary. Good tilth is easily maintained, and the soils can be tilled over a wide range of moisture conditions without injury. The soils are not ordinarily susceptible to erosion, except where scouring of stream banks occurs locally. Diversion ditches may be necessary in some areas to prevent excessive overwash from the adjacent upland slopes. The use suitability range and general productivity of the imperfectly drained members probably could be increased by artificial drainage. The advisability of drainage and the kind of drains to use on any particular area, however, will depend on many factors, including cost, feasibility of drainage from an engineering standpoint, and the kind and extent of other soils on the farm.

The soils of this group, although very well suited, are seldom used for pasture because they are so well suited to crops. The fact that they generally remain moist and productive throughout hot dry periods, however, makes them especially valuable for pasture. When used for pasture, superior management includes the use of amendments, chiefly lime and phosphate, on suitable pasture plants and the proper control of grazing. On pastures that receive adequate amendments and are properly grazed, the problem of weed control is not serious, but mowing may be necessary to remove excess herbage and undesirable plants.

MANAGEMENT GROUP 2.—UNDULATING SOILS OF THE COLLUVIAL SLOPES AND TERRACES

The soils of management group 2 are good to excellent for crops and pasture. They are relatively high in fertility, easy to work and conserve, and productive of most of the crops commonly grown. Ordinarily they are not susceptible to inundation by floodwater, and consequently they have a wider range of adaptation than those of group 1. All are deep, permeable soils with moisture conditions favorable for growing plants. Most of the soils included in this group are well drained. The Camp and Greendale soils are well to imperfectly drained. The Whitwell soil, however, is unfavorable for plant growth. For all the soils, the content of organic matter and plant nutrients is moderate to high and the water-holding capacity is high. Although not susceptible to flooding, the Greendale and Camp soils do receive from the adjacent slopes some sediments that tend to replenish the content of plant nutrients and organic matter. Good tilth is easily maintained on the soils of group 2, and they can be tilled over a fairly wide range of moisture conditions without injury. The soils of management group 2 and their yields under two levels of management are listed in table 7.

These soils are well suited to practically all of the crops commonly grown in the area. They are especially well suited to tobacco and to

TABLE 7.—*Soils of management group 2: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Camp silt loam	40	60	16	22	30	40	1. 2	1. 6	1. 4	1. 7	95	200	1, 550	2, 000	95	140
Greendale silt loam	45	60	18	24	33	43	1. 2	1. 6	1. 4	1. 8	100	210	1, 650	2, 100	65	132
Hayter loam, undulating phase	45	60	20	28	40	55	1. 4	1. 8	1. 6	2. 1	150	250	1, 600	2, 100	90	145
Made land	40	55	18	24	25	45	1. 1	1. 6	1. 5	2. 0	130	210	1, 500	1, 900	70	125
Masada silt loam, undulating phase	40	55	19	26	35	50	1. 1	1. 4	1. 4	1. 8	130	235	1, 400	1, 800	70	132
Sequatchie loam, undulating phase	40	55	18	25	30	45	1. 1	1. 4	1. 4	1. 8	140	240	1, 425	1, 875	60	120
Sequatchie silt loam, undulating phase	40	60	18	25	30	45	1. 1	1. 6	1. 5	2. 0	150	250	1, 500	1, 900	70	125
Whitwell silt loam	30	50	10	15	20	35	1. 0	1. 4	1. 2	1. 8	130	180	1, 000	1, 400	60	110

[1] See footnote 10 in the text for definition of this term.

vegetable crops such as cabbage, green beans, and potatoes. With proper fertilization and liming, alfalfa and red clover are successfully grown. These soils are not so well suited to corn as those of group 1 but are better suited than most soils of the upland.

A. Present use and management.—Practically all the acreage in management group 2 has been cleared and is being used rather intensively for the production of crops. Only a very small part of these soils is ever idle, but an appreciable acreage is occupied by roads, house and barn sites, and barnyards. Corn, beans, burley tobacco, wheat, red clover, and lespedeza are the chief crops. Red clover, alone or mixed with timothy or orchardgrass, is the chief hay crop, but a considerable acreage of lespedeza is sown in small grain for hay or pasture. This group includes some of the most desirable soils in the county for tobacco and snap beans and produces the major portion of these crops. There is very little permanent pasture, but an appreciable acreage of rotation pasture.

A wide variety of crops are grown but generally not in a systematic rotation. A few farmers follow a corn-small grain-red clover rotation. It is a fairly common practice to follow the row crops with a winter cover crop, especially the tobacco and bean crops. Crimson clover and the small grains are fall-sown, either as a part of the regular rotation or especially for winter cover.

Moderate to heavy fertilization is a common practice on soils of this group. The bean and tobacco crops receive heavy applications of a complete fertilizer such as 3–9–6, 5–10–5, or 4–12–4. Beans generally receive 250 to 600 pounds. Tobacco receives 800 to 1,200 pounds of fertilizer an acre, and some farmers now believe it profitable to use as much as 2,000 pounds an acre. Fertilizer is much less frequently used on corn and small grains, and applications are much lighter. Lime is commonly applied preceding the legume crop in the rotation, but the use of lime and fertilizer varies greatly in amount and frequency of application. Some farmers apparently overlime. Tillage operations are carried out with more care and with greater promptness than on other soil groups. Insect and disease control, however, is inadequate for complete crop protection.

B. Suggested management.—The soils of this management group are suited to rather intensive use for crop production. If other management requirements are met and a legume is included, these soils apparently can be conserved and their productivity maintained or increased under a rotation that includes a row crop every other year or every third year. Winter cover crops and green manure crops are useful as a means of conserving soil moisture and improving tilth and as a source of nitrogen and humus. In planning the choice and rotation of crops, it should be kept in mind that these soils are well suited to such exacting deep-rooted legumes as red clover and alfalfa. A rotation of corn, small grain, and red clover and grass should be well suited. Any of the truck crops or tobacco can be substituted for the corn in this rotation. Another cropping system that appears to be well suited consists of an intertilled crop followed by a small grain and lespedeza. If properly fertilized, a rotation consisting of a row crop such as tobacco or snap beans followed by crimson clover may be adequate.

The soils of management group 2 are generally slightly to moderately deficient in lime, phosphorus, nitrogen, and possibly potash for

high yields of most of the crops commonly grown. However, the crop response to fertilization is excellent.[12] Moderate applications of lime and phosphate are necessary for the successful growth of the deep-rooted legumes, such as alfalfa and red clover, and greatly increase the yields of other legume crops, especially lespedeza. Nitrogen is required for high yields of practically all crops except legumes. Almost all crops respond well to applications of phosphate. The need for potash will depend to a large extent on the crop to be grown, the previous cropping system, and the level of production. Heavy applications of a complete high-grade fertilizer are desirable for vegetable crops, tobacco, or potatoes. Properly conserved manure is an excellent source of both nitrogen and potash, but should be supplemented with phosphate to obtain a balance of plant nutrients. Deficiencies in minor elements may develop under a continued high level of production. Boron will probably be needed for the successful production of alfalfa on most of these soils.

Good tilth is easily maintained on these soils, and tillage can be carried on over a fairly wide range of moisture conditions without seriously impairing their physical properties. Some gravel and cobbles are on most areas but do not interfere materially with tillage. Control of erosion and conservation of soil moisture are not serious problems when crops are properly chosen and adequate amendments are used. Engineering devices for erosion control generally are not needed, but contour tillage may be desirable.

These soils are well suited to pasture. Good pastures are generally obtained without any special preparation except seeding. To obtain high-yielding pastures of good quality, however, at least moderate applications of lime and phosphate are necessary. Properly controlled grazing and fertilization are usually effective in weed control, but mowing may be necessary.

MANAGEMENT GROUP 3.—ROLLING SOILS OF UPLANDS, COLLUVIAL SLOPES, AND TERRACES

The soils of management group 3 are fair to good for crops and fair to very good for pasture. They are moderately easy to work and conserve but vary considerably in productivity. They are deep, very friable to friable, well drained, and permeable to air, roots, and water. Slopes range from about 5 to 12 percent. Rainfall is readily absorbed. The water-holding capacity is moderately high, and the content of plant nutrients ranges from moderate to high.

These soils are all moderately eroded and are somewhat less permeable, lower in water-holding capacity, lower in plant nutrients, and less friable than similar uneroded soils. Nevertheless, they have not been significantly injured for crop production. None has sufficient stones in the plow layer to interfere materially with tillage, although some cobbles, gravel, chert, or other rock pieces may occur.

The Hagerstown, Matney, and Jefferson soils differ appreciably from the other soils of the group but are included because of limited acreage. The Hagerstown soils are finer textured, less friable, and less permeable and are somewhat more difficult to work and conserve. The Jefferson and Matney soils are coarser textured and generally lower in plant nutrients than other soils of the group. The soils of management group 3 and their yields under two levels of management are given in table 8.

[12] See footnote 11, page 86.

TABLE 8.—*Soils of management group 3: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Hagerstown silty clay loam, eroded rolling phase	40	55	21	29	40	55	1. 2	1. 6	1. 5	1. 9	100	180	1, 350	1, 750	65	125
Hayter loam, eroded rolling phase	40	55	15	24	35	50	1. 3	1. 6	1. 4	1. 9	120	200	1, 400	1, 900	80	132
Jefferson loam, eroded rolling phase	18	40	8	16	15	30	. 7	1. 1	1. 0	1. 5	80	150	500	975	50	108
Masada silt loam, eroded rolling phase	35	50	14	22	30	45	. 9	1. 3	1. 3	1. 7	110	190	1, 200	1, 600	60	120
Matney loam, eroded rolling phase	25	45	10	18	20	35	. 6	1. 4	1. 0	1. 5	120	180	1, 100	1, 400	60	115
Shouns silt loam, eroded rolling phase	35	50	14	22	30	50	1. 2	1. 5	1. 3	1. 7	110	190	1, 400	1, 800	75	130
Tusquitee loam, eroded rolling phase	40	60	14	24	30	50	1. 1	1. 6	1. 2	1. 8	130	200	1, 500	1, 900	90	145

[1] See footnote 10 in the text for definition of this term.

These soils are suited to a wide variety of crops including corn, wheat, oats, barley, tobacco, and many vegetables; and if properly fertilized, such crops as red clover and alfalfa can be grown successfully.

A. Present use and management.—All of the soils of management group 3 have been cleared and used for crops and pasture. At present a significant acreage is idle or in unimproved pasture and a part is in improved permanent pasture. These soils are used much less intensively for crop production than those of management groups 1 and 2. In general the management level is not so high. If similar management practices are followed, they are less effective in maintaining the productivity of the soils because of the more exacting requirements. Corn, small grains, lespedeza, and red clover are the chief crops. Considerable acreages of beans and tobacco may be grown on these soils on farms that do not have sufficient acreage of the soils of management group 1 or 2 for these crops.

A wide variety of crops are grown, and many farmers follow some form of rotation, which is generally irregular. The better farmers use a rotation made up of corn, small grain, and red clover and grass. A great many of the soils, however, are used for crops until yields begin to get very low and then are put in pasture or hay for an indefinite period. Winter cover crops are grown on a smaller proportion of these soils than on those of management group 2.

Crops on these soils, especially tobacco and beans, are moderately to heavily fertilized by some farmers. Fertilization, however, is less frequent and not so common for all crops as on the smoother soils of the valleys. Complete fertilizers, such as 3–9–6 are generally used for row crops; superphosphate alone is commonly used for hay crops and pasture. Practically all farmers lime the soil before the red clover crop, but the rate of application varies greatly. Disease- and insect-control measures for the bean and tobacco crops are not usually adequate. Present management practices do not make the best use of water on the soils. Some farmers have controlled runoff and erosion, but erosion is still active on many areas. Engineering devices for erosion control are not commonly used.

B. Suggested management.—The soils of this group are more exacting in their management requirements than those of management group 2. Longer rotations and heavier fertilization as well as better water-control measures are required. If other management practices are good, the soils can be maintained in a 4- to 6-year rotation. For example, a rotation consisting of corn, small grain, clover and orchardgrass for 3 years, tobacco, and crimson clover is well suited. Almost any of the other row crops commonly grown can be substituted for either the corn or tobacco in this rotation; and, by lengthening the rotation, alfalfa could replace the red clover. It is important that a cover crop follow all intertilled crops.

These soils are deficient in lime, phosphorus, and nitrogen for high yields of most crops, but they vary considerably in the degree of deficiency. The Jefferson and Matney soils are more deficient than the other members and are generally highly deficient in potash. The legume crops, especially deep-rooted legumes, require lime and phosphorus; but if inoculated, they do not need nitrogen.[13] Potash will also

[13] See footnote 11, p. 86.

be required for the deep-rooted legumes on most of these soils. An inoculated legume crop will generally supply enough nitrogen for other crops in a rotation, especially if turned under. All crops respond well to applications of phosphorus. Truck crops and tobacco need a complete fertilizer. Properly conserved manure is a good source of nitrogen and potash, but it should be supplemented with a phosphate fertilizer to obtain a balance of plant nutrients.

Good tilth is easily maintained. Tillage operations can be carried on over a fairly wide range of moisture conditions except on the Hagerstown soil, where maintenance of good tilth is more difficult. Most of the soils are somewhat stony, but this condition does not materially interfere with tillage. These soils are susceptible to erosion, but runoff and erosion control should not be a serious problem if other management practices are good. Contour tillage should be practiced where feasible, however, and contour stripcropping may be advisable on the long slopes. Terraces or other engineering devices for runoff and control should not be necessary unless a shorter rotation than suggested above is to be used. The soils are deep and permeable. Generally they have regular slopes and should be well suited to the use of terraces if satisfactory outlets are available.

These soils are physically well suited to pasture. The requirements of pasture management are chiefly the supplying of amendments, mainly lime and phosphate, to suitable pasture plants and proper control of grazing. For pastures that receive adequate amendments and are properly grazed, the problem of weed control is not serious, but an occasional mowing may be necessary.

MANAGEMENT GROUP 4.—UNDULATING AND ROLLING STONY SOILS OF COLLUVIAL SLOPES AND TERRACES

The soils of this group are characterized by a large quantity of stones, gravel, or cobbles on the surface and throughout the profile. For the most part they are poor to fair for tilled crops and fair to very good for permanent pasture. They are medium to strongly acid and high to moderate in content of organic matter and plant nutrients. They are deep, very permeable, and moderately high in water-holding capacity. Slopes range from about 2 to 12 percent, and the soils are slightly to moderately susceptible to erosion. The soils of this management group differ from those of management group 2 chiefly in being stony and consequently more difficult to till, but they are also normally less fertile and have less favorable moisture conditions for plant growth. The soils of management group 4 and their yields under two levels of management are listed in table 9.

These soils are fairly well suited to most of the common crops of the county, but their suitability is somewhat limited by stoniness and droughtiness. They are apparently well suited to early vegetable crops and fairly well suited to crops such as crimson clover, red clover, and the small grains. They are less suited to crops that mature late in summer or early in fall.

A. Present use and management.—The soils of this management group are closely associated with those of management group 2, but because of their large content of stones and cobbles and greater slope range, they are used less intensively for agriculture. An appreciable acreage is in forest, virgin or second-growth; a fairly high percentage is idle each year; and a significant acreage is used for house and barn

TABLE 9.—*Soils of management group 4: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Hayter stony loam, undulating phase	35	55	15	24	35	50	1. 2	1. 5	1. 3	1. 8	120	200	1, 300	1, 800	65	125
Hayter stony loam, rolling phase	(2)	50	(2)	20	(2)	45	(2)	1. 3	(2)	1. 6	(2)	190	(2)	1, 700	(2)	120
Hayter stony loam, eroded rolling phase	30	45	13	20	30	43	1. 0	1. 3	1. 2	1. 6	100	180	1, 200	1, 600	60	115
Sequatchie cobbly loam, undulating phase	30	45	14	20	23	38	. 9	1. 2	1. 2	1. 6	120	200	1, 200	1, 600	55	108
Sequatchie cobbly loam, eroded rolling phase	25	40	12	18	20	35	. 8	1. 1	1. 1	1. 5	100	180	1, 000	1, 400	50	100
Tusquitee stony loam, eroded rolling phase	30	50	12	20	25	40	. 9	1. 4	1. 0	1. 5	110	180	1, 300	1, 700	75	125

[1] See footnote 10 in the text for definition of this term.
[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

sites, barnyards, and roadways. Practically all of the common crops of the county are grown on these soils, the chief of which are corn, wheat, oats, tobacco, beans, red clover, and lespedeza.

Although a wide variety of crops are grown, only a few farmers follow a systematic rotation. The corn-small grain-red clover rotation is most commonly used. A winter cover crop such as crimson clover, red clover, or a small grain is used following a row crop on probably less than half the acreage. Moderately heavy fertilization is practiced for some crops, especially tobacco and beans, but the applications are light on such crops as corn and wheat. Generally a complete fertilizer—3–9–6, 5–10–5, or 4–12–4—is used at the rate of 250 to 600 pounds an acre for beans, 800 to 1,200 pounds for tobacco, and 250 to 450 pounds for corn or wheat. Lime, 2 to 3 tons an acre, is generally applied preceding the red clover or alfalfa crop. The use of superphosphate on pastures and legume hay crops is becoming a common practice. Tillage and insect and disease control are reasonably well carried out but could be improved considerably.

B. Suggested management.—These soils are suited to moderately intensive use for crop production; but to maintain or increase yields, better crop rotation and fertilization probably will be required. The rotation can be moderately short but should include a legume. A rotation consisting of corn, wheat, and red clover or red clover and grass appears to be suitable. Any of the row crops can be substituted for the corn in the rotation, and any of the small grains for the wheat.

Although these soils are generally less highly leached than the associated soils of the uplands, they are moderately deficient in lime, phosphorus, nitrogen, and possibly potash. Applications of lime and phosphate are essential for the successful growth of alfalfa or red clover. Practically all crops will make an excellent response to the application of phosphorus. Nitrogen is also deficient for all except the legume crop. For most of the soils, potash is not so likely to be deficient, but probably will be needed for alfalfa and potatoes.[14] Barnyard manure is an excellent source of nitrogen, potash, and organic matter for all crops.

The large quantity of stones, gravel, or cobbles in these soils materially interferes with tillage. In some places it may be practical to remove the larger loose stones and thus improve the workability of the soils. These soils are susceptible to erosion in places, and tillage should be on the contour wherever feasible. Erosion control should not be a serious problem if the soils are kept under a vegetative cover most of the time and are properly fertilized.

The soils of this group are fair to good for pasture. They produce very good early pasture, but generally poor pasture late in summer and early in fall. A pasture mixture including bluegrass, orchardgrass, redtop, white clover, red clover, hop clover, and lespedeza is well suited to these soils. Pasture management consists chiefly of supplying lime and phosphorus to properly selected pasture mixtures, proper control of grazing, and mowing to remove excess herbage and to eradicate weeds.

MANAGEMENT GROUP 5.—ROLLING STONY SOILS OF UPLANDS AND COLLUVIAL SLOPES

The soils of this group are poor to fair for crops and fair to good for pasture. All are deep, well drained, moderate to low in plant

[14] See footnote 11, p. 86.

nutrients, organic matter, and water-holding capacity, and medium to strongly acid. They are permeable to air, roots, and water. Slopes range in gradient from 5 to 12 percent. These soils are light colored and characterized by a high content of stone, chert, or cobbles on the surface and throughout the profile. The soils of management group 5 and their yields under two levels of management are given in table 10.

These soils are suited to most of the crops of the county, but their suitability is somewhat limited by stoniness and droughtiness. They are apparently well suited to early vegetable crops. They would also be expected to be fairly well suited to crops such as crimson clover, red clover, and the small grains. They are not so well suited to crops that mature late in summer or early in fall.

A. Present use and management.—About one-fourth of the acreage of the soils of management group 5 is still in forest, and possibly as much as one-fourth is idle each year. The rest is used for pasture and the common crops of the county. Pastures are generally poor and unimproved. Corn, small grains, tobacco, and beans are the common crops. Lespedeza is the most extensive hay crop.

Although a variety of crops are grown, very few farmers follow a systematic rotation. Corn-small grain-lespedeza or corn-small grain-red clover are the most common rotations. On many farms, however, these soils are cropped for 2 or 3 years and then put in unimproved pasture for an indefinite period, the length of the period depending mainly on the farmer's need for cropland. The crops fertilized and the kinds of fertilizer used are similar to those in management group 4, but the number of farmers using fertilizer and the rate and frequency of application are considerably less. Tobacco and beans receive most of the fertilizer, and lime is generally applied only preceding red clover or alfalfa. Tillage, as well as insect and disease control, is less carefully practiced than on the soils of management group 4.

B. Suggested management.—It may be desirable to use these soils largely for pasture on many farms. Because of the difficulty of tillage, many farmers favor a long rotation such as corn, wheat, and then pasture for 3 to 5 years. If a more intensive use is necessary, a rotation of corn, small grain, and then red clover and grass for 3 years is suitable. Any of the commonly grown row crops can be substituted for the corn in this rotation.

Practically all of these soils need lime, phosphorus, and nitrogen if they are to produce high yields. They may also be deficient in potash.[15] The application of lime, phosphate, and potash is essential for the successful growth of alfalfa and red clover. Practically all crops will make a very good response to phosphate fertilizers. Nitrogen is also essential for high yields of all except possibly the legume crops. Potash is not so likely to be a limiting element, except for such crops as alfalfa and potatoes. Barnyard manure is an excellent source of nitrogen, potash, and organic matter for all crops.

These soils are susceptible to erosion, and tillage should be on the contour where feasible. Engineering devices for water control should not be necessary if fertilization is adequate and crop rotations similar

[15] See footnote 11, p. 86.

A, Dotted line encloses Stony rough land, Ramsey soil material on steep slopes in the Ramsey soil association. This land type supports a sparse forest.
B, A good pasture on Teas-Litz shaly silty clay loams, eroded hilly phases.

A, Cornfield in center of picture on Tusquitee soil. Tusquitee soils, formed at the break of upland slopes are relatively inextensive but very important to the agriculture of the Porters-Tusquitee-Clifton soil association area.

B. An area of the Teas-Litz-Shouns-Camp soil association showing the characteristic dome-shaped hills. Sequatchie soils are in immediate foreground; Whitwell soil in middle distance.

A, Land-use pattern on a farm in the Hayter-Sequatchie soil association. Hayter loam, eroded rolling phase, in foreground; Sequatchie soils in cornfield, left middle distance; Hayter stony loam, eroded hilly phase, on cleared slope; and Ramsey soils on wooded mountainous slopes in background.

B, Second-growth forest in the Hayter-Sequatchie soil association area. The white pines (left) are on Hayter soils and the hardwood trees (right) are on Hamblen soils. Practically all the soils in this association are very productive of forest and were formed under a dense forest cover.

A, A typical landscape in the Porters-Tusquitee-Clifton soil association. In contrast to most of the other soil associations of the mountains, a large part of this area is cleared and used for crops and pasture.

B, Practically all of the Ramsey soil association (high ridge in background) is in yellow pine-hardwood forest. Jefferson and Hayter soils are on the cleared areas in foreground.

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TABLE 10.—*Soils of management group 5: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Elliber cherty silt loam, eroded rolling phase	25	40	10	16	20	32	0.8	1.3	1.2	1.6	70	135	800	1,200	50	105
Jefferson stony fine sandy loam, rolling phase	(2)	30	(2)	15	(2)	28	(2)	1.1	(2)	1.4	(2)	130	(2)	850	(2)	100
Jefferson stony fine sandy loam, eroded rolling phase	10	25	5	14	10	25	.5	1.0	.8	1.3	65	125	300	750	40	95
Jefferson stony loam, rolling phase	(2)	35	(2)	15	(2)	30	(2)	1.2	(2)	1.4	(2)	140	(2)	1,025	(2)	102
Jefferson stony loam, eroded rolling phase	15	30	5	13	12	25	.6	1.1	.8	1.3	70	130	550	900	35	95

[1] See footnote 10 in the text for definition of this term.
[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

to those suggested is used. The workability of the soils can be improved by removing the loose stones, but this is generally practical for only very small areas.

The soils of this group are fair to good for pasture. Moderate to heavy applications of lime, phosphate, and potassium are generally required, however, to establish and maintain high yielding pastures of good quality. A pasture mixture including bluegrass, orchardgrass, redtop, white clover, hop clover, and lespedeza is well suited. Other management practices consist of proper control of grazing, mowing to remove excess herbage, and weed control.

MANAGEMENT GROUP 6.—HILLY SOILS OF THE COLLUVIAL SLOPES AND TERRACES

The soils of management group 6 differ from those of management group 3 chiefly in having stronger slopes—the gradient ranges from 12 to 25 percent. They are poor to fair for crops and fair to very good for pasture. The stronger slopes have increased the difficulty of tilling and conserving these soils, and maintaining them requires a higher level of management than is needed for soils of management group 5. They are deep, well-drained permeable soils, moderately well supplied with organic matter and plant nutrients, but they vary because of past cropping practices and degree of erosion. They retain water well and have a moderately high water-holding capacity. None have sufficient stones to interfere materially with tillage, although some cobbles, stone, or gravel are in all. The soils of management group 6 and their yields under two levels of management are given in table 11.

These soils are well suited to a wide variety of crops, including corn, wheat, oats, barley, tobacco, and many vegetables. If properly fertilized, crops such as alfalfa and red clover are successfully grown. However, the exacting conservation requirements may greatly limit the choice of crops and frequency of planting.

A. Present use and management.—Practically all of these soils have been cleared and used for crops or pasture. A considerable acreage is idle each year, and a small part is being allowed to revert to forest. Small grains, lespedeza, and red clover are the most common crops. Tobacco and beans are grown on only a very small acreage, but pasture occupies a greater acreage than in any of the preceding groups.

Systematic rotation of crops is not commonly practiced on the soils of this management group. Generally a row crop is grown one or more years and followed by several years of meadow or pasture. The frequency of row crops depends largely on the fertility level of the field and the need of the farmer for cropland. The crops and the fertilizers used are similar to those of management group 3. The rate and frequency of application of lime and fertilizers vary a great deal from farm to farm. Although the management is similar in many respects to that of management group 3, it is less effective in maintaining the productivity of the soils. Owing chiefly to the stronger slopes, runoff is more rapid and erosion consequently greater. Very few of the farmers are making any special effort to prevent excessive runoff.

B. Management requirements. These soils are quite exacting in their management requirements. Good tillage practices, proper and

TABLE 11.—*Soils of management group 6: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management. Blank spaces indicate crop is not commonly grown and soil is unsuited to its production under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Hayter loam, hilly phase	(2)	50	(2)	22	(2)	45	------	1.4	------	1.8	(2)	195	(2)	1,600	(2)	120
Hayter loam, eroded hilly phase	30	45	13	21	25	40	1.0	1.3	1.3	1.7	135	190	1,100	1,500	65	115
Masada silt loam, eroded hilly phase	30	45	12	20	25	40	.8	1.2	1.1	1.5	130	190	1,000	1,400	60	110
Shouns silt loam, eroded hilly phase	28	43	12	20	25	40	1.0	1.3	1.2	1.6	130	185	1,100	1,500	65	110
Tusquitee loam, eroded hilly phase	30	50	12	22	25	45	1.0	1.5	1.1	1.7	130	185	-------	(2)	80	132

[1] See footnote 10 in the text for definition of this term.
[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

adequate fertilization, and a long rotation that consists chiefly of close-growing crops are needed. A rotation consisting of corn, small grain, and red clover and orchardgrass for 4 years is suitable for most areas. However, a rotation made up of barley or other small grain and red clover and orchardgrass for 3 years would probably give greater protection from erosion. A few farmers successfully use a rotation consisting of a small grain crop seeded in contour furrows and followed by lespedeza.

These soils are deficient in lime, phosphorus, and nitrogen for continued high yields of most crops, but they vary considerably in degree of deficiency. The legume crops, especially the deep-rooted ones, require lime and phosphorus, but do not need nitrogen if they have been inoculated. Potash may also be needed on the deep-rooted crops, as well as on such crops as potatoes. All crops respond well to phosphate fertilizer, and heavy applications of a complete fertilizer are required for truck crops and tobacco.

Good tilth is fairly easily maintained. These soils, except for some of the more eroded spots that are subject to puddling and clodding, can be tilled over a wide range of moisture conditions. The growing of grasses, deep-rooted legumes, and green manure crops and the use of barnyard manure will tend to improve the tilth. Runoff and loss of soil material through erosion are difficult to control. This loss can be reasonably checked by using a long rotation consisting chiefly of close-growing crops such as suggested above, and by following the contour in all tillage operations. Contour stripcropping may be advisable on the longer slopes. Where contour tillage or stripcropping is not feasible because of very irregular slopes, the omission of row crops altogether should be considered.

These soils are well suited to pasture, and best used for it on many farms. Pasture management consists mainly of supplying amendments, chiefly lime and phosphate, to suitable pasture plants. On the more severely eroded spots pasture stands are somewhat difficult to establish but are aided greatly by applications of barnyard manure and nitrate fertilizers. After the pasture is established, however, the legumes in the pasture mixture should supply most of the nitrogen needed for high yields. Grazing should be controlled so as to maintain a good sod at all times. On pastures that receive adequate amendments and are properly grazed, weed control is not a serious problem, but an occasional clipping may be necessary.

MANAGEMENT GROUP 7.—HILLY MEDIUM-TEXTURED SOILS OF THE UPLANDS

Well drained to excessively drained soils of the mountain uplands are included in management group 7. They are poor to fair for crops and fair to very good for pasture. They are medium-textured, very permeable soils relatively well supplied with organic matter but varying greatly in content of plant nutrients. The water-holding capacity is only moderate, but owing to the favorable rainfall distribution, moisture seldom limits crop production. Slope gradients range from 12 to 25 percent. The soils are fairly easy to work but moderately difficult to conserve. The soils of management group 7 and their yields under two levels of management are given in table 12.

Because of favorable climate and physical characteristics, these soils are very well suited to vegetable crops such as beans and cabbage, and potatoes, and to buckwheat and most clovers and grasses.

TABLE 12.—*Soils of management group 7: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Matney loam, eroded hilly phase	18	35	9	16	18	33	.5	1.2	0.9	1.4	70	140	900	1,200	55	110
Perkinsville loam, hilly phase	(2)	38	(2)	17	(2)	32		.9	(2)	1.4	(2)	140	(2)	1,100	(2)	95
Perkinsville loam, eroded hilly phase	18	35	9	16	18	30	.5	1.1	.9	1.3	70	140	800	1,100	50	100
Porters loam, eroded hilly phase	18	35	10	16	18	30	.5	1.0	.9	1.3	65	135	800	1,200	50	100

[1] See footnote 10 in the text for definition of this term.

[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

They are apparently not very well suited to the small grain crops. The suitability of the soils for certain crops may vary considerably because of differences in altitude or topographic position.

A. Present use and management.—Most of these soils have been cleared and used for crops and pasture. About 10 to 15 percent of the total acreage is still in forest. An appreciable acreage is idle each year and some is reverting to forest. A relatively large part is in rotation or permanent pasture. Corn, tobacco, beans, and red clover are the chief crops.

The present level of management varies very widely. A few farmers follow a systematic crop rotation, adequately lime and fertilize, and follow good tillage and good insect- and erosion-control practices. Other farmers grow crops continuously as long as the soil will produce, with few, if any, good management practices, and then abandon the soil or put it in pasture. However, most farmers follow a management level somewhere between these extremes.

B. Suggested management.—Owing to the hilly relief and susceptibility to accelerated erosion, these soils are rather poorly suited to intertilled crops. They are better suited to close-growing crops and pasture. The hilly relief makes difficult the use of grain binders or other heavier types of machinery in many areas. The requirements for tillage and choice and rotation of crops are exacting. A long rotation, 6 years or more, is desirable on most farms. A rotation consisting of corn, small grain, and red clover and orchardgrass for 4 or 5 years appears to be suitable. Tobacco or any of the vegetable crops can be substituted for the corn in this rotation.

These soils need lime, phosphate, and nitrogen if they are to produce high yields of most crops, but they vary greatly from place to place and from one soil to another in degree of deficiency. Nitrogen is required for high yields of all except legume crops and the crop immediately following. Lime and phosphate are required for success with most of the legume crops. All crops respond well to applications of phosphate fertilizers. The Porters and Perkinsville soils generally do not need potash, except for very exacting crops such as potatoes, but the Matney soil may be very deficient. The need for potash, however, will vary greatly on any of the soils, depending on the crop to be grown, the preceding crops, and the level of production.

These soils should be protected from erosion by a vegetative cover as much of the time as feasible. Tillage should be as nearly on the contour as possible. Stripcropping, also on the contour, is a desirable practice on long regular slopes. Narrow strips of intertilled crops should alternate with strips of legume and grass hay or other close-growing crops. Commonly the strips are 40 to 60 feet wide, but the width will depend largely on the slope.

These soils are well suited to most clovers and grasses, and good pastures can be established and maintained by using adequate quantities of amendments. Moisture conditions are comparatively very favorable for pasture production, especially during the summer and fall. The grazing season is somewhat shorter than in the valleys, however. Lime and phosphorus are the chief amendments required, but nitrogen may be needed if the proportion of legumes in the mixture is low. Properly controlled grazing and fertilization will control weeds in most places, but some clipping may be necessary.

MANAGEMENT GROUP 8.—HILLY MODERATELY FINE TEXTURED SOILS OF THE UPLANDS

The soils of this group are fair for crops and fair to very good for pasture. They are relatively fertile upland soils that are somewhat difficult to work and conserve. The present content of organic matter and plant nutrients depends largely on the past cropping system and loss of material by erosion, but in general it is relatively high. These soils are well drained, moderate in water-holding capacity, generally 5 feet or more deep, and medium to strongly acid. They have firm subsoils that are plastic when wet. Slopes range from 12 to 25 percent. The soils of management group 8 and their yields under two levels of management are given in table 13.

These soils are physically well suited to practically all of the crops commonly grown in the county. They are very well suited to alfalfa and most of the other hay crops and pasture, but they are not so well suited to corn, tobacco, and truck crops. The exacting management requirements will greatly limit the choice of crops and frequency of planting.

A. Present use and management.—Practically all of these soils have been cleared and used for crops and pasture. Corn, small grain, lespedeza, red clover, alfalfa, tobacco, and beans are common crops. At the present time, a considerable acreage of these soils is idle or in pasture.

A systematic crop rotation is not generally followed, but the soils of this management group are kept in close-growing crops or pasture longer than similar less sloping soils. A few farmers use contour stripcropping and a 3- or 4-year rotation, and this practice appears to be increasing, especially in the mountainous areas. Applications of fertilizer are lighter and less frequent than on the smoother soils of the valleys. Lime is difficult to apply, and the amounts applied have not been adequate on many farms. In general the management on these soils has not made the best use of the water on the land. Runoff has been high and erosion is active on most of the areas.

B. Suggested management.—These soils are fairly well suited to crops under a high level of management, but on most farms they are best used for pasture or semipermanent hay crops. If row crops are to be grown, they should be in a long rotation that consists chiefly of close-growing or preferably sod-forming crops. A 6-year rotation should be adequate if other practices are good; for example, corn, small grain, and then red clover and orchardgrass or alfalfa for 4 years. It is important that a cover crop follow all intertilled crops. Tobacco and beans can well be substituted for corn in the rotation.

Fertilization and liming are of great importance, not only to maintain moderate to high yields but also to establish quickly and to maintain a sod that will protect the soils from excessive erosion. Lime and phosphate are especially needed for legumes and grasses. Nitrogen is a general requirement except where supplied by legumes. Some potash is usually needed for the deep-rooted legumes.

The loss of soil material by erosion has resulted in the loss of organic matter and plant nutrients, lowered water-holding capacity, and increased difficulty in maintaining good tilth. The soils cannot be safely tilled over a wide range of moisture conditions; they are subject to puddling when too wet and clodding when too dry. It is important that tillage operations be properly timed. The growing of grasses

TABLE 13.—*Soils of management group 8: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management. Blank spaces indicate crop not commonly grown and soil unsuited to its production under management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pastures	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Clifton clay loam, eroded hilly phase	30	50	13	20	23	40	1.0	1.5	1.4	1.8	70	145	1,200	1,600	60	120
Hagerstown silty clay loam, eroded hilly phase	30	45	13	21	23	40	.9	1.3	1.3	1.7	65	140	-------	(2)	55	115

[1] See footnote 10 in the text for definition of this term.

[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

and green manure crops tends to improve tilth. Contour tillage aids materially in conserving soil moisture and soil material. Where this is not feasible because of the abundance of sinkholes or very irregular slopes, the rotation should be longer and the omission of row crops considered. On long and regular slopes contour stripcropping permits more intensive use of the soils without excessive soil loss. Observations indicate that with well-laid-out strips as much as one-fourth of the acreage can be maintained in row crops, provided other management practices are good.

These soils are well suited to pasture. Fair pastures can be established and maintained without the use of amendments, but a very good response is expected from the use of lime and phosphate. Pasture stands on the more severely eroded spots are somewhat difficult to establish but are aided greatly by applications of barnyard manure and nitrogen. After the pasture is established, however, the legumes in the pasture mixture should supply most of the nitrogen needed for high yields. Other management practices include clipping to control undesirable plant growth and the control of grazing to prevent injury to the stand.

MANAGEMENT GROUP 9.—HILLY STONY AND VERY STONY SOILS OF THE COLLUVIAL SLOPES AND VERY STONY ALLUVIAL SOILS

The soils of management group 9 differ from those of management group 4 chiefly in having steeper slopes. Slopes range from 12 to 25 percent but in some places are less than 12 percent. The soils are generally poorly suited to crops requiring tillage, principally because of stoniness and strong slopes. The stones, cobbles, or gravel interfere materially with tillage on most of the soils and prohibit feasible tillage on the stony land types. The content of plant nutrients and organic matter varies greatly but is moderate to low for most of the soils. These soils are deep, very permeable, and moderate to low in water-holding capacity. Their yields under two levels of management are given in table 14.

A wide variety of crops, including all the common crops of the county, can be successfully grown on most of the soils of management group 9 under a high level of management. These soils are probably best used for semipermanent hay or pasture crops on most farms, however.

A. Present use and management.—About one-half the acreage of these soils is in cutover forests. The rest has been cleared and used for crops and pasture, but some areas are reverting to forest, and a considerable part is idle or in nonfarm uses. A wide variety of crops are grown with highly variable results. Corn, small grains, lespedeza, and red clover are the chief crops. Tobacco and beans are grown on a limited acreage, but they are a very important source of income to the farms on which soils of this management group occur.

Systematic crop rotations are followed on very few farms, but many farmers grow legume crops or pasture at rather frequent intervals. Lime and fertilizer are applied at definitely lower rates and less frequently than on the smooth, nonstony soils of the valleys. The small acreage of beans and tobacco, however, receives moderately heavy applications of a complete fertilizer. The difficulty of applying amendments to these stony, hilly soils discourages their use. Tillage, in gen-

TABLE 14.—*Soils of management group 9: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management. Blank spaces indicate crop is not commonly grown and soil is not suited to its production under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Cobbly alluvium, Hamblen and Sequatchie soil materials															60	108
Hayter stony loam, hilly phase	(2)	40	(2)	18	(2)	40	(2)	1. 2	(2)	1. 5	(2)	125	(2)	1, 500	(2)	110
Hayter stony loam, eroded hilly phase	20	35	11	17	20	35	. 8	1. 1	1. 0	1. 4	60	120	1, 000	1, 400	55	105
Jefferson stony fine sandy loam, hilly phase	(2)	25	(2)	13	(2)	25	(2)	1. 0	(2)	1. 2	(2)	95			(2)	90
Jefferson stony loam, hilly phase	(2)	28	(2)	14	(2)	28	(2)	1. 1	(2)	1. 3	(2)	100		(2)	(2)	95
Jefferson stony loam, eroded hilly phase	10	25	5	12	10	20	. 5	1. 0	. 7	1. 1		100		(2)	30	85
Stony colluvium, Jefferson soil material															20	50
Stony colluvium, Tusquitee soil material															25	60
Tusquitee stony loam, eroded hilly phase	20	35	8	18	16	30	. 8	1. 2		1. 3		110			60	105

[1] See footnote 10 in the text for definition of this term.

[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

eral, is reasonably prompt and careful. Water-control measures vary in effectiveness, and erosion is active in many fields.

B. Suggested management.—The establishment and maintenance of good pastures on these soils will require moderate to heavy applications of lime and phosphate to a suitable pasture mixture. A mixture including bluegrass, orchardgrass, whiteclover, hop clover, and lespedeza is well suited. Fertilization and properly controlled grazing will go a long way toward controlling weeds. Because of stoniness and strong slopes, mowing is a very difficult and ineffective way to control weeds in most areas. On suitable soils it is a good practice to grow an intertilled crop, such as corn, once every 8 to 10 years, if weeds are crowding out the desirable pasture plants.

On some farms lacking a sufficient acreage of better soils it may be necessary to use these soils for crops. If so, the management will be similar to that for the soils of management group 4. However, the crop rotation will need to be longer and include more close-growing crops, and tillage on the contour will be more necessary. Contour stripcropping may also be desirable.

MANAGEMENT GROUP 10.—HILLY STONY SOILS OF THE UPLANDS

Management group 10 includes stony, hilly soils chiefly in the mountains. Mainly because of strong slopes and stoniness, these soils are poorly to very poorly suited to crops that require tillage, but they are fairly well suited to pasture. They are very friable, permeable, and moderate to low in content of plant nutrients and organic matter. The water-holding capacity is moderately low, but the amount and distribution of rainfall is such that plants are seldom seriously injured by lack of moisture. There are enough stones on all of these soils to interfere materially with tillage or to prohibit it in some places. The Ramsey soils, which are by far the most extensive of the group, are very low in natural fertility and poorly suited to pasture production. The soils of management group 10 and their yields under two levels of management are given in table 15.

A. Present use and management.—About 85 to 90 percent of the acreage of this group is forested. Most of the small part cleared is being used for crops and pasture. Some areas are idle and others have been abandoned and are reverting to forest. Most of the cleared areas are in unimproved pasture. The management level of these soils is very low; fertilizers and lime are not commonly used on crops or pasture, nor are the crops systematically rotated.

B. Suggested management.—Indications are that fair to good pastures can be established and maintained on these soils by the use of sufficient amendments and control of grazing and weeds. Lime and phosphate are general requirements for good yields on all the soils. Potash may be needed on the Ramsey soils but should not be needed on the others. Nitrogen may be necessary in establishing the pasture, as well as on the established pastures that have few legumes in the pasture mixture. If properly fertilized, the soils are suited to pasture plants such as bluegrass, orchardgrass, redtop, whiteclover, hop clover, and lespedeza. The control of weeds will be difficult unless the pastures are properly grazed and fertilized. The growing of an intertilled crop at 7- to 10-year intervals may be necessary to eliminate weeds in some pastures.

TABLE 15.—*Soils of management group 10: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management. Blank spaces indicate crop is not commonly grown and soil is unsuited to its production under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Ashe stony loam, hilly phase	(2)	35	(2)	16	(2)	30	(2)	0.8				(2)		1,000	(2)	90
Ashe stony loam, eroded hilly phase	15	30	7	11	17	28	.3	.6	.8	1.2		(2)	600	800	50	85
Elliber cherty silt loam, hilly phase	(2)	30	(2)	15	(2)	28	(2)	1.0	(2)	1.3		(2)	(2)	1,000	50	100
Elliber cherty silt loam, eroded hilly phase	15	25	6	14	13	28	.6	1.0	.9	1.2		(2)		900	45	95
Ramsey stony loam, hilly phase															25	55

[1] See footnote 10 in the text for definition of this term.

[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

MANAGEMENT GROUP 11.—POORLY DRAINED SOILS OF THE BOTTOM LANDS AND TERRACES

The soils of management group 11 are poorly suited to crops, but fair to good for pasture. They are poorly drained and occur in nearly level to slightly depressed areas. The Prader and Dunning soils are on stream bottoms that are subject to flooding, and the Tyler soils are on stream terraces. The Tyler soils are low in fertility and strongly to very strongly acid. The Prader and Dunning soils vary considerably both in fertility and reaction. The soils of management group 11 and their yields under two levels of management are given in table 16.

The soils of this management group, if adequately drained, would be suitable for crops requiring tillage, but the draining of the Tyler soil is beset with difficulties and is of doubtful practicability. The soils of this group are, however, considered suitable for pasture under natural drainage conditions, although the Tyler soil is low in productivity of pasture plants.

A. Present use and management.—A large part of these soils has been cleared and used for crops or pasture, but most of the larger cleared areas are now in pasture. The smaller areas are used and managed with the associated better drained soils. A considerable part of the cleared areas has grown up in alder and willow thickets. Some corn and other summer annual crops are grown on these soils under natural drainage conditions, but results are very disappointing and complete crop failures are common. Amendments are rarely used. Some attempts have been made to drain many areas, mainly with open ditches, but they have been largely ineffective.

B. Suggested management.—These soils furnish a fair quantity of pasture throughout spring, summer, and fall; but the quality is only poor to fair. The first step in pasture improvement should be directed toward improving moisture conditions. Open ditches, bedding, and diversions would improve drainage considerably in most places. Tiling also would probably be effective for the Prader and Dunning soils but not very effective for the Tyler soil because of its claypan. After drainage has been improved, seedings of bluegrass, orchardgrass, whiteclover, redtop, and lespedeza can be expected to do fairly well, especially if lime and phosphate are used where needed. Redtop and lespedeza are grown successfully without amendments, but the pastures are of lower quality. Weeds should be controlled by grazing and mowing.

Although considered poorly suited to crops requiring tillage, these soils may be fairly well suited to crops that can be planted late in spring or early in summer and harvested in fall. Sorghum and soybeans are well suited to such use. If effectively drained, use and management of the soils of this management group would be similar to that for the imperfectly drained soils of management group 1, although crop yields would not be expected to be as high.

MANAGEMENT GROUP 12.—ROLLING TO STEEP SHALLOW SHALY SOILS

The soils of management group 12 are shallow and shaly and have steep, hilly, and rolling relief. The eroded soils generally consist of a mixture of soil material and partially weathered shale only a few inches thick. Because of extreme susceptibility to injury from erosion, crop injury from droughts, and steep relief, these soils are poorly or

TABLE 16.—*Soils of management group 11: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management. Blank spaces indicate crop is not commonly grown and soil is unsuited to its production under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Dunning silt loam		35					0. 6	1. 3				(2)			40	120
Prader silt loam		33					. 6	1. 1				(2)			40	115
Tyler silt loam		30					. 5	1. 0				(2)			40	108

[1] See footnote 10 in the text for definition of this term.

[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

TABLE 17.—*Soils of management group 12: Expected average acre yields of the principal crops under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management. Blank spaces indicate crop is not commonly grown and soil is unsuited to its production under the management specified]

Soil	Corn		Wheat		Oats		Lespedeza		Red clover		Beans		Tobacco		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Teas shaly silt loam, steep phase																72
Teas shaly silty clay loam, eroded steep phase																60
Teas shaly silty clay loam, eroded hilly phase															30	80
Teas-Litz silt loams, hilly phases															[2]	85
Teas-Litz shaly silty clay loams, eroded hilly phases															30	78
Teas-Litz silt loams, steep phases															[2]	78
Teas-Litz shaly silty clay loams, eroded steep phases											[2]	[2]			30	72
Teas-Litz shaly silty clay loams, eroded rolling phases	13	18	5	10	10	20	0.5	0.8	0.7	1.1	[2]	[3]	300	750	45	102

[1] See footnote 10 in the text for definition of this term.

[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

very poorly suited to tilled crops. The rolling phases are chiefly on narrow, winding ridge crests surrounded by hilly and steep phases that are not suited to tilled crops. In this position they generally cannot be feasibly used for crops, but fair pastures can be maintained under a high level of management. The soils of this management group are apparently well supplied with lime and potash in most places but are low in content of phosphorus and nitrogen. The Litz soils are strongly acid. All have a low to very low water-holding capacity. The soils of management group 12 and their yields under two levels of management are given in table 17.

A. Present use and management.—More than half of the acreage of these soils has been cleared and used for crops and pasture. The greater part of the cleared areas is now in unimproved pasture, a considerable part is reverting to forest, and a very small part is used for crops. The crops are very poorly managed and yields are low. Lime and fertilizers are used by only a few farmers. A few pastures have been improved by the application of lime and phosphate, the seeding of good pasture mixtures, and the eradication of weeds. The greater acreage, however, is not improved in any way, and generally erosion is active and pasture yields are very low.

B. Suggested management.—Although these soils are naturally fairly productive of pasture, they are responsive to good management practices. Phosphorus is the chief fertilizer requirement, and liberal applications will be needed at frequent intervals. The Litz soils generally need lime, but other soils should be tested before lime is applied. An initial application of potash may be necessary; but after the pasture is well established, potash will probably not be needed if droppings are kept scattered. In establishing the pasture, nitrogen will be required and applications of barnyard manure, especially on the galled spots, will be beneficial. Nitrogen may also be required if the proportion of legumes in the mixture is low.

Since pastures on these soils are subject to injury from droughts, grazing must be carefully controlled, especially during dry periods. Emergency pastures are advisable for the dry summer and early fall months. Subsoiling on the contour to a depth between 15 and 20 inches is thought to be beneficial on some areas, as it decreases runoff and increases water-holding capacity. This practice is not generally feasible in areas that have hard rock outcrops. Controlled grazing and the use of amendments are largely effective in the control of weeds, although clipping may be necessary.

MANAGEMENT GROUP 13.—STEEP SOILS

Management group 13 consists of steep relatively stone-free soils of the uplands. Because of steep slopes combined with one or more undesirable characteristics or conditions such as low fertility, shallowness, severe erosion, or extreme susceptibility to erosion, these soils are poorly or very poorly suited to crops. They are poor to fair for pasture, but on many farms they are probably best left in forest or reforested if cleared. The soils of management group 13 and their yields under two levels of management are given in table 18.

TABLE 18.—*Soils of management group 13: Expected average acre yields of hay and pasture under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management. Blank spaces indicate crop is not commonly grown and soil is unsuited to its production under the management specified]

Soil	Lespedeza		Pasture	
	A	B	A	B
	Tons	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Ashe loam, steep phase	(2)	0.8	(2)	90
Ashe loam, eroded steep phase		.7	30	85
Hagerstown silty clay loam, eroded steep phase			45	95
Porters loam, steep phase	(2)	.9	(2)	100
Porters loam, eroded steep phase	.4	.8	50	95

[1] See footnote 10 in text for definition of this term.

[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

A. Present use and management.—More than half of the acreage of these soils has been cleared of forest cover and is being used chiefly for pasture. Some of the cleared areas have been abandoned and are reverting to forest. A small acreage is being used for crops. A few farmers, especially in the mountain area, are practicing strip-cropping, which along with adequate fertilization appears to be maintaining or improving the soil. The difficulty of applying amendments has largely discouraged their use, however, especially on pastures.

B. Suggested management.—Although these soils are not generally productive of pasturage at present, indications are that fair to good pastures can be established and maintained by good management. Lime and phosphate are needed on practically all soils. Some potash may be needed in establishing pastures on some of the soils, but none will likely be needed for established pastures. Nitrogen may be required in establishing pastures or for pastures that have a low proportion of legumes in the stand. Although amendments are needed for most of these soils, they may be very difficult or almost impossible to apply, especially on the mountain soils. If properly fertilized, most of the soils are suited to pasture plants, such as bluegrass, orchardgrass, redtop, whiteclover, red clover, hop clover, and lespedeza. Grazing must be carefully controlled in order to aid in weed control and to maintain a good sod at all times. Weed control will be difficult, but the less steep areas can be mowed.

Although poorly suited to crops, these soils may be needed for cropland in some places. When so used, management practices should include supplying lime, phosphorus, and possibly potassium; maintaining or increasing nitrogen and humus; and conserving soil moisture and soil material in order to maintain productivity. Long ro-

tations consisting largely of close-growing hay and small grains are best suited. All tillage should be approximately on the contour, and contour stripcropping may be desirable.

MANAGEMENT GROUP 14.—STEEP STONY AND VERY STEEP SOILS, STONY ROUGH LANDS, AND MINE PITS

The soils of this group have some characteristic, or combination of undesirable characteristics, such as shallow depth, stoniness, steep slopes, or low fertility, which largely precludes their use for either crops or pasture. On most farms they are probably best used for

TABLE 19.—*Soils of management group 14: Expected average acre yields of hay and pasture under two levels of management, Johnson County, Tenn.*

[Yields in columns A are to be expected under present management; those in columns B are to be expected under suggested management. Blank spaces indicate crop is not commonly grown and soil is unsuited to its production under management specified]

Soil	Lespedeza		Red clover		Pasture	
	A	B	A	B	A	B
	Tons	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Ashe stony loam, steep phase					[2]	72
Ashe stony loam, eroded steep phase					30	65
Ashe stony loam, very steep phase						
Elliber cherty silt loam, steep phase					45	90
Elliber cherty silt loam, eroded steep phase					40	85
Hayter stony loam, steep phase	[2]	1.0		[2]	[2]	100
Hayter stony loam, eroded steep phase		0.9		[2]	45	90
Jefferson stony fine sandy loam, steep phase						78
Jefferson stony fine sandy loam, eroded steep phase						72
Jefferson stony loam, steep phase						80
Jefferson stony loam, eroded steep phase						75
Mine pits						
Porters stony loam, steep phase					50	85
Porters stony loam, eroded steep phase					40	72
Ramsey stony loam, steep phase						
Ramsey stony loam, very steep phase						
Stony rough land, Ashe and Porters soil materials						
Stony rough land, Elliber and Teas soil materials					15	45
Stony rough land, Ramsey soil material						
Teas-Litz shaly silt loams, very steep phases						

[1] See footnote 10 in the text for definition of this term.

[2] Crop not commonly grown; soil considered suited to it although less so than to crops for which yield predictions are given.

forest. The soils vary greatly in such characteristics and conditions as depth to bedrock, content of plant nutrients and organic matter, and water-holding capacity.

A. Present use and management.—Most of the soils of this group are in forest. A small acreage, however, has been cleared and used mainly for pasture. Some of this is reverting to forest. Management of crops and pasture is at a very low level, and crop yields are generally low or are declining rapidly.

B. Suggested management.—A notable proportion of these soils is in forest at present, and a program of reforestation probably should be carried out on the remaining acreage. In places a suitable forest cover will establish itself if properly protected against fire and grazing by livestock; in others, planting will be necessary.

Most of the management practices used in the production of timber are listed as follows: (1) Maintenance of a full stand of desirable species, (2) systematic cutting and weeding of trees, (3) harvesting of the mature trees in such a manner that desirable species may succeed them, and (4) the control, so far as possible, of fires, browsing, trampling, and damage from other causes. The first three practices are strictly those of forest management, whereas the fourth pertains to both soil and forest management.

Idle or abandoned areas generally volunteer to white pine provided seed trees are nearby. However, forest tree plantings may be necessary on some areas. Success with these plantings requires certain advance preparation of the soil and the selection of a species that suits the particular soil and climate. White pine is generally recommended in this area. Soil preparation for planting includes such measures as breaking and mulching galled areas, building simple check dams in gullies, and plowing contour furrows. Landowners are encouraged to do the entire job on privately owned lands, using forest tree seedlings provided without cost by the Tennessee Valley Authority.

Although these soils are not physically suited to crops and pasture, lack of a sufficient acreage of better soils may force some farmers to use them for these purposes. Where the production of tilled crops is attempted, adequate liming and fertilizing and every reasonable practice for water control are needed. The use of amendments and careful selection and rotation of crops are especially needed to encourage heavy vegetation. Stripcropping may be advisable on some slopes.

For the maintenance of pastures, additions of lime and fertilizers, particularly phosphorus, and other good management practices are required. Legumes should make up a considerable part of the pasture sod. Application of materials and control of weeds are difficult in many places, chiefly because of the steep slopes, stoniness, and inaccessibility.

OTHER INTERPRETIVE SOIL GROUPINGS

Plans requiring detailed data, such as the layout and operation of a farm, are aided by use of the detailed soil map. Plans of a more general nature may be facilitated by grouping soils having specific characteristics. For example, the grouping presented in the section on Use and Management of Soils places together those soils similar in use suitability and management requirements. The groups are shown in different shades on the soil map.

In the following pages two other soil groupings are discussed: (1) degree of suitability for agricultural use (land classes) and (2) broad landscapes (or soil associations). The soil associations are shown on the soil map that accompanies this report. The land class groupings are not shown on a map, but they closely correlate with the management groups shown by color on the detailed soil map. Management groups 1 through 8 consist of First-, Second-, and Third-class soils, management groups 9 through 13 consist mainly of Fourth-class soils, and management group 14 consists mainly of Fifth-class soils.

LAND CLASSES

Three conditions—productivity,[16] workability,[17] and conservability [18]—determine the physical suitability of the soils for agricultural use. On the basis of their relative suitabilities for agriculture, the soils of Johnson County are grouped into five classes—First-, Second-, Third-, Fourth-, and Fifth-class soils.

Information obtained from farmers, soil surveyors, extension workers, experiment station workers, and others who work with the soil was used in placing the soils in these five land classes. Comparisons that took into consideration productivity, workability, and conservability were made among the soils. For example, a farmer knows that some soils on his farm are better suited than others to agriculture. By comparisons of this nature within farms and among farms, the soils may be placed in the approximate order of their physical suitability for agriculture. For soils for which information based on experience is lacking, the rankings may be arrived at by comparison with soils of similar productivity, workability, and conservability for which information is available.

This grouping into five land classes is not to be taken as a recommendation for use. Its purpose is to provide information as to the relative physical suitability of the various soils for the present agriculture of the area. Knowledge of the particular circumstances applying to a specific farm is necessary in making recommendations for land use on that farm.

FIRST-CLASS SOILS

The First-class soils are productive, easy to work, and easy to conserve; and, consequently, they are physically well suited to the production of crops common to the county. They are good to excellent soils for crops that require tillage and for permanent pasture.

All are relatively well supplied with plant nutrients, as compared with other soils of Johnson County, but they are all responsive to fertilization for some crops. Although usually slightly deficient in lime, they contain more than most other soils of the county. All are

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[16] Productivity as used here refers to the capacity of a soil to produce crops and pasture plants. This capacity is dependent not only upon the proper supply of nutrients but also upon such air and water relations as will make possible the efficient use of available nutrients by plants.

[17] Workability refers to the ease of tillage, harvesting, and other field operations. Texture, structure, consistence, stoniness, and degree of slope are important among the properties that affect workability.

[18] Conservability refers to the ease of maintaining the productivity and workability of the soil.

well drained, but their physical properties are such that they retain moisture well, and maintain an adequate and even supply for plant growth. Good tilth is easily obtained and maintained, and tillage can be carried on over a comparatively wide range of moisture conditions. The soils are fairly well supplied with organic matter in comparison with other soils of the county. The physical properties of these soils favor normal circulation of air and moisture, and roots penetrate all parts of the subsoil freely.

None of these soils has any prominent adverse soil conditions. They are almost free of stone, and have relief favorable to soil conservation and tillage. None is severely eroded or highly susceptible to erosion. All have relatively high natural fertility and are easily tilled. The problem of conservation of soil fertility and of the soil material itself is relatively simple.

The First-class soils cover 1,485 acres, or about 0.7 percent of the county. They are listed as follows:

Hagerstown silty clay loam, eroded rolling phase
Hayter loam, undulating phase
Masada silt loam, undulating phase
Sequatchie silt loam, undulating phase

SECOND-CLASS SOILS

Second-class soils are physically good soils for agriculture. They are fair to good for crops that require tillage and fair to excellent for permanent pasture.

All are at least moderately productive of most of the crops commonly grown in the area. Their physical properties are at least moderately favorable for tillage, maintenance of good tilth, and normal circulation and retention of moisture. None occupies slopes greater than 12 percent, and none has stones in quantities sufficient to interfere seriously with tillage operations. None is severely eroded. Each is moderately deficient in one or more properties that contribute to productivity, workability, or conservability; but none is so seriously deficient in any property that it is poorly suited to tilled crops.

The deficiencies vary widely among the soils. Some are fertile but are sloping and moderately eroded; others are almost level and uneroded but are relatively low in content of plant nutrients or restricted in drainage. The soils of the group are relatively similar in their suitabilities for agriculture, but management requirements vary widely because of the many different kinds of soils included.

The Second-class soils cover 9,210 acres, or about 5 percent of the county. They are the following:

Camp silt loam
Chewacla loam
Congaree fine sandy loam
Greendale silt loam
Hamblen loam
Hayter loam, eroded rolling phase
Hayter stony loam, undulating phase
Made land
Masada silt loam, eroded rolling phase
Sequatchie loam, undulating phase
Shouns silt loam, eroded rolling phase
Staser fine sandy loam
Tusquitee loam, eroded rolling phase
Whitwell silt loam

THIRD-CLASS SOILS

Physically, Third-class soils are fair for agriculture. They are poor to fair for crops that require tillage and fair to very good for permanent pasture.

Each soil is so deficient in workability, conservability, or productivity, or in some combination of the three, that its physical suitability for tilled crops is decidedly limited. These soils are better suited physically to crops that require tillage than Fourth-class soils but are less well suited than Second-class soils. One or more unfavorable conditions, such as low content of plant nutrients, low content of organic matter, low water-holding capacity, undesirable texture, structure, or consistence, strong slopes, stoniness, or inadequate natural drainage, limit suitability for crops that require tillage. Because of the diversity of characteristics among the soils of the group, management requirements range widely.

Third-class soils cover 21,412 acres, or about 11.1 percent of the county. They are listed as follows:

Chewacla gravelly fine sandy loam
Clifton clay loam, eroded hilly phase
Elliber cherty silt loam, eroded rolling phase
Hagerstown silty clay loam, eroded hilly phase
Hayter loam:
  Hilly phase
  Eroded hilly phase
Hayter stony loam:
  Rolling phase
  Eroded rolling phase
  Hilly phase
  Eroded hilly phase
Jefferson loam, eroded rolling phase
Jefferson stony fine sandy loam:
  Rolling phase
  Eroded rolling phase
Jefferson stony loam:
  Rolling phase
  Eroded rolling phase
Masada silt loam, eroded hilly phase
Matney loam:
  Eroded rolling phase
  Eroded hilly phase
Perkinsville loam:
  Hilly phase
  Eroded hilly phase
Porters loam, eroded hilly phase
Sequatchie cobbly loam:
  Undulating phase
  Eroded rolling phase
Shouns silt loam, eroded hilly phase
Teas-Litz shaly silty clay loams, eroded rolling phases
Tusquitee loam, eroded hilly phase
Tusquitee stony loam, eroded rolling phase

FOURTH-CLASS SOILS

Fourth-class soils are poor for crops that require tillage and poor to very good for permanent pasture. They are poor soils for agriculture, mainly because they are well suited to such a limited number of uses. Nevertheless, some of these soils may be important on those farms where soils suited to permanent pasture are in great demand.

Each soil of this group is so difficult to work or so difficult to conserve, or both, that the management needed to produce tilled crops successfully is not feasible under present conditions. On some farms, however, soils well suited to tilled crops may be so limited that the intensity of soil management needed for the successful use of Fourth-class soils for tilled crops may be practical. On farms where enough soils well suited to crops are available, Fourth-class soils are generally used for pasture. A considerable acreage of Fourth-class soils is used for crops, however, mainly on farms that have so small an acreage of soils better suited to crops that it will not satisfy the needs of the operator. The intensity of management practiced on areas of these soils used for crops is generally not adequate for good soil conservation. As on the Third-class soils, management requirements both for crops that require tillage and for pasture vary widely.

Fourth-class soils, include 63,257 acres, or about 33 percent of the county. They are listed as follows:

Ashe loam:
  Steep phase
  Eroded steep phase
Ashe stony loam:
  Hilly phase
  Eroded hilly phase
Cobbly alluvium, Hamblen and Sequatchie soil materials
Dunning silt loam
Elliber cherty silt loam:
  Hilly phase
  Eroded hilly phase
  Steep phase
Hagerstown silty clay loam, eroded steep phase
Hayter stony loam:
  Steep phase
  Eroded steep phase
Jefferson stony fine sandy loam, hilly phase
Jefferson stony loam:
  Hilly phase
  Eroded hilly phase
Porters loam:
  Steep phase
  Eroded steep phase
Prader silt loam
Ramsey stony loam, hilly phase
Stony colluvium:
  Jefferson soil material
  Tusquitee soil material
Teas shaly silt loam, steep phase
Teas shaly silty clay loam:
  Eroded steep phase
  Eroded hilly phase
Teas-Litz silt loams, hilly phases
Teas-Litz shaly silty clay loams, eroded hilly phases
Teas-Litz silt loams, steep phases
Teas-Litz shaly silty clay loams, eroded steep phases
Tusquitee stony loam, eroded hilly phase
Tyler silt loam

FIFTH-CLASS SOILS

Fifth-class soils are very poorly suited to agriculture. They are very poor for crops that require tillage and poor to very poor for permanent pasture.

Each soil of this group is so difficult to work, so difficult to conserve, or so low in productivity, or has such combinations of these unfavorable properties, that the intensity of management necessary for its successful use for crops requiring tillage is not generally feasible. Furthermore, common pasture plants produce very little feed on these soils because of low content of plant nutrients or poor moisture relationships, or both. These soils are apparently best suited to forest under present conditions, even though they are probably less productive of forests than soils of any of the preceding groups. Existing conditions of the locality or of the farm unit may require the use of some of the soils of this class for pasture or for crops in spite of their poor suitability in their present condition.

The Fifth-class soils cover 95,996 acres or about 50 percent of the county. They are listed as follows:

Ashe stony loam:
  Steep phase
  Eroded steep phase
  Very steep phase
Elliber cherty silt loam, eroded steep phase
Jefferson stony fine sandy loam:
  Steep phase
  Eroded steep phase
Jefferson stony loam:
  Steep phase
  Eroded steep phase
Mine pits
Porters stony loam:
  Steep phase
  Eroded steep phase
Ramsey stony loam:
  Steep phase
  Very steep phase
Stony rough land:
  Ashe and Porters soil materials
  Elliber and Teas soil materials
  Ramsey soil material
Teas-Litz shaly silt loams, very steep phases

SOIL ASSOCIATIONS [19]

Not only do soils occur in characteristic positions on the landscape, a fact that has been brought out in the descriptions of the separate soils, but they also occur in rather characteristic geographic association. The Elliber soils, for example, occur on the cherty slopes of the lowland belts and are generally associated with the Greendale soil. Likewise, the Staser soil occurs on the stream bottoms and is generally associated with the Hamblen soil of the bottoms and the Sequatchie soils of the low terraces.

By placing soils that are geographically associated in groups, it is possible to prepare a generalized map that shows the areas dominated by each group of such associated soils. On such a basis, the soils of Johnson County have been placed in 12 groups, which are here called soil associations and which have fairly well defined geographic boundaries. The soil association map is on the Shady Valley sheet of the soils map.

A soil association may consist of a few soils or of many. These soils may be similar or greatly different. In each soil association, however, there is a certain uniformity of soil pattern. The soil association in which a soil occurs may have a great influence on its present and potential use. For example, a soil suitable for corn may or may not be used for that crop, depending on the soils with which it is associated. Its association with other soils good for corn or poor for corn will often determine how frequently it is planted to corn and also the kind of rotation used. Most farms use not one soil, but a group of soils that occur together on the landscape. It is this association of soils that makes it possible for a farm to develop the particular combination of enterprises that produces its income.

The delineation of soil association areas affords a means of selecting sample farms for business analysis, replanning, or preparing demonstrations that will be fairly representative of a whole group of farms, as far as soils are concerned. The delineated soil association areas can be used to transfer to similar soil areas the knowledge gained by analysis or on demonstration or sample farms.

A brief discussion of each soil association area follows. More detailed information about the component soils can be obtained from the discussion of the soils in the section on Soils of Johnson County, Their Use and Management.

1. DUNNING-PRADER-SEQUATCHIE ASSOCIATION

The Dunning-Prader-Sequatchie is a small soil association, it occurs in Shady Valley and makes up 0.8 percent of the county area. It is a nearly level area predominantly poorly drained. Dunning and Prader soils are the most extensive, but there is an appreciable acreage of Sequatchie and Whitwell soils. The Dunning and Prader soils are on the level or depressed areas near the center of the soil association. The Sequatchie soils are on higher lying areas, mainly around the outer part of the association or on low ridges extending into Prader or Dunning soil. The Whitwell soil is intermediate in position.

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[19] A soil association may be defined either as a group of soils occurring together in a characteristic pattern or as a landscape characterized as to the kind, proportion, and distribution of its component soils.

All farms on this soil association include a part of the adjacent Hayter-Sequatchie association, which is better suited to crops. About four-fifths of the Dunning-Prader-Sequatchie association consists of Fourth-class soils that are used predominantly for unimproved pasture. Much of it has grown up to willow and alder thickets. The small acreage of First- and Second-class soils is used and managed like the soils of the adjacent soil association.

Since the farms do have a considerable acreage of good cropland in another soil association, there has been little need for intensive use of the soils of this association. Artificial drainage would be expected to improve the pastures and broaden the use suitability of the Dunning and Prader soils, but these soils would still be largely limited to summer annual crops because of their susceptibility to floods. The finding of a practical means of draining the soils is an important problem for the farmers.

2. SEQUATCHIE-STASER-HAMBLEN ASSOCIATION

The Sequatchie-Staser-Hamblen is a long, narrow association consisting of the first bottoms and low terraces along some of the larger streams. It includes only 3.4 percent of the county area. The Sequatchie soils are the most extensive, but there is an important acreage of Staser and Hamblen soils. Small acreages of Prader, Camp, Shouns, and Greendale soils are also included. The Staser and Hamblen soils are on the nearly level first bottoms, and the Sequatchie soils are on the nearly level to undulating low terraces only a few feet above the first bottoms.

This association consists mainly of First- and Second-class soils, and it is the most intensively used area in the county. Farms usually include parts of adjacent associations that are generally less well suited to crop production. Consequently, most of the crops are grown on this association, and the pastures and forests are on the adjacent colluvial lands or uplands.

A general type of farming is commonly followed. A wide variety of crops is grown, management is generally at a high level, and crop yields are relatively very high. The soils are well suited to intensive use for crop production. They are especially well suited to vegetable crops, such as snap beans, and this suitability has greatly influenced the type of farming or crop speciality. Land values are very high in this soil association, and in general the farms are the most prosperous in the county.

These soils, especially the Sequatchie, are well suited to practically all the common crop and pasture plants grown in the county. The Staser and Hamblen soils are somewhat limited in use suitability by susceptibility to flooding. They are best suited to summer annual crops, although perennial and winter annual crops are grown. Management requirements are not exacting. Fertilization and crop rotation are desirable but are not so necessary as on some other soils of the county. Water control is not a serious problem; runoff is slow and the water-holding capacity of the soils is adequate for high yields. Many farms lack sufficient acreage of these soils to provide a well-balanced crop and pasture rotation.

3. TEAS-LITZ-SHOUNS-CAMP ASSOCIATION

The Teas-Litz-Shouns-Camp is the most extensive association in the lowland belt; it occupies about 11.5 percent of the county. Relief is predominantly hilly to steep; the areas in this association are characterized by round-topped or dome-shaped hills (pl. 10, *B*): Teas, Litz, Shouns, and Camp soils occupy most of the association, but small acreages of Jefferson, Hayter, Staser, Hamblen, Sequatchie, Whitwell, and Greendale soils are included. Teas and Litz soils, in a very complex association, are on practically all of the uplands. In many places remnants of old colluvial material, or of Jefferson or Hayter soils, overlie these soils near the mountains. Shouns soils are on the old colluvial areas at the base of the Teas-Litz slopes; they occur in small tracts but are widely distributed throughout the association. The Camp soil is on the young alluvial-colluvial deposits at the base of slopes and along the small intermittent drainageways. Staser and Hamblen soils are on the few areas of first bottoms, and Sequatchie and Whitwell soils are on the low terraces.

Fourth-class soils are by far the most extensive in this association. First- and Second-class soils, mainly Second-class, occupy about 10 percent of the soil association area and are fairly well distributed. The First- and Second-class soils are confined to the alluvial and colluvial areas. Many areas of the Camp and Shouns soils are so isolated from other crop-adapted soils that it is not feasible to use them for crops. The small acreage of crop-adapted soil has resulted generally in too intensive use and resultant lowering of productivity, or in a type of farming requiring a minimum of row crops.

Most of the farms in this association are either the small general type or those producing mainly for home use. Livestock (mainly beef cattle) farms are increasing, however, and are in general making good use of all the land. The uplands (Teas-Litz soils) are being used for pasture, and the Shouns and Camp soils for feed crops. A very small acreage of cash crops, beans, or tobacco, is also grown on most farms. On the general farms or on those producing for home use, the crop-adapted soils are farmed very intensively; but very little use is made of the Fourth-class soils, which are generally idle or in unimproved pasture. The level of management, as well as the apparent well-being of the farmers, varies greatly from farm to farm.

Because of the small percentage of crop-adapted soils, it is difficult to use the soils of this association according to their capabilities unless the farms extend into other associations that have more crop-adapted soils. Even on livestock farms, it is difficult to maintain adequate pasture during hot, dry months on the Teas-Litz soils or to produce sufficient feed for wintering the livestock. Grazing must be carefully controlled to maintain a good sod that will prevent excessive erosion. The management of soils and farms in this soil association is difficult. Management of the small farms is especially difficult. Obtaining adequate yields without lowering the productivity of the soils is a serious problem.

4. ELLIBER-HAGERSTOWN-GREENDALE ASSOCIATION

The Elliber-Hagerstown-Greendale association occurs in small areas throughout the central lowland belt and includes about 4 percent of the county. The only large area is in the southern part of the county east of Butler (now inundated). The association has a hilly

to steep relief. The Elliber soils, by far the most extensive, occupy about 80 percent of the association. The Hagerstown and Greendale soils, though much less extensive, are very important to the agriculture of the association. The Elliber soils are on most of the uplands; the Hagerstown soils, also on the uplands, occur in small areas widely distributed throughout the association. The Greendale soil occurs on the colluvial areas at the base of slopes and along the small intermittent drainageways. Stony rough land, Elliber and Teas soil materials, is on many of the steeper slopes bordering the streams.

Fourth- and Fifth-class soils occupy most of the uplands. Second- and Third-class soils, mainly Greendale and Hagerstown, are very limited in extent. They occur in small tracts widely distributed throughout the association. An estimated one-third of the soil association area is in white pine-hardwood forest. In general, the soils of the association are poorly suited to pasture; the acreage of those that are suited to crops is also very limited on any farm. A considerable part of the soils physically suited to crops is used for house or barn sites, barnyards, and roads.

On this association the farms are of the general type or the type producing mainly for household use. Use is not well adapted to soil capabilities, and the management level is low. The association supports a relatively small population at a low standard of living.

The big problem on farms in this soil association is that of producing enough to support the farm family without reducing the productivity of the soils. In many cases, adequate production can be obtained only by depleting the soil. Apparently these are needed: (1) Better adjustment of use to the capability of the soils, and (2) improved management designed to make the best use of soil and water resources through better adapted crop rotations, proper fertilization, prompt and careful tillage practices, and other supporting water-control practices.

5. HAYTER-SEQUATCHIE ASSOCIATION

The Hayter-Sequatchie association includes practically all of Shady Valley and also the Valley of Sutherland, or about 3.7 percent of the county. These areas have a covelike topography that slopes towards the center from all sides. The slopes are hilly or steep next to the mountains and become gradually milder (nearly level to undulating) near the center of the valley. Hayter soils occupy most of the acreage, but there are important areas of Sequatchie soils. The small acreage of first bottom soils is either Prader soil or Cobbly alluvium, Hamblen and Sequatchie soil materials. The soils are relatively stone free near the center of the valley and more stony near the upland slopes.

An estimated 50 percent of the association consists of Second-class, 30 percent Third-class, 10 percent First-class, and 10 percent Fourth-class soils. The land classes are fairly well distributed in this approximate proportion throughout the association, and most of the farm units include some of each. The proportions and distribution of the various land classes and the wide range in suitability of the soils are favorable for the development of highly diversified general type of farms (p. 11, *A*).

This association includes one of the more prosperous farming communities in the county. Practically all of the soils are well suited either to crops or pasture. A well-diversified general type of farming

is common. Beans, burley tobacco, beef cattle, and dairy products are important sources of income. Most of the land is cleared and is being used moderately intensively for crops or pasture. A small acreage, chiefly the steeper and stonier areas, is still in forest, mainly white pine-hardwoods or hemlock-hardwoods (pl. 11, *B*). Use and management of the soils are apparently moderately well adjusted to their capability and needs for maintenance.

Most of the farms of moderate size have a wide choice in selection of crops and type of farming, and, in general, there is very little need to use the soils for unsuited crops. Management requirements are not exacting if the use is well adjusted. Proper selection of crops, a suitable rotation, adequate fertilization, and reasonable supporting practices for water control are necessary on all farms, however.

6. JEFFERSON-HAYTER ASSOCIATION

The Jefferson-Hayter association is made up of most of the colluvial areas in the valleys of Doe, Roan, and Laurel Creeks. These areas are predominantly steep near the mountains, but are less steep, rolling, or hilly near the streams. Stony types of Jefferson and Hayter soils are by far the most extensive. However, the small acreages of relatively stone free Jefferson, Hayter, Sequatchie, and Staser soils are very important to the agriculture. Cobbly alluvium, Hamblen and Sequatchie soil material, is along most of the small drainageways in the area. The association includes about 13.4 percent of the county.

About 85 percent of this association consists of Fourth-class soils; the rest is chiefly Third-class, but there is a small acreage of Second-class soils. The small acreages of Third- and Second-class soils are widely distributed in small tracts and in many places are isolated by large areas of Fourth-class soils. Roads, houses, barns, and barnyards occupy an important part of these soils.

The relatively few farms entirely within this association are chiefly of the small general farms or farms producing mainly for home use. About 50 percent or more of the association is still in white pine-hardwood forest. Most of the acreage in this association makes up part of farms that are principally in the Teas-Litz-Shouns-Camp and the Elliber-Hagerstown-Greendale associations. On these farms the soils are used mainly for unimproved pasture or are in forest.

Lack of sufficient acreage of crop-adapted soils in this association greatly limits the types of farming. The large acreage of potential pastureland is steep and stony, and the establishment and maintenance of pastures is difficult. Moreover, very few of the farms have a sufficient acreage of crop-adapted soil to produce the necessary feed for a livestock farm. Soils in this association are probably best used and managed as a part of farms in the adjacent valley association.

7. ASHE-TUSQUITEE-PERKINSVILLE ASSOCIATION

The Ashe-Tusquitee-Perkinsville is a rough mountainous association consisting chiefly of steep Ashe soils. However, a small acreage of Perkinsville soils occurs on the smoother mountain crests and a small acreage of Tusquitee soils or Stony colluvium, Tusquitee soil material, along the drains. The area is characterized by narrow, winding mountain crests, steep or very steep mountain slopes, and narrow valleys. The association makes up about 10.4 percent of the county.

About 90 percent of the association is Fourth- and Fifth-class soils, about equally divided, and the rest is chiefly Third-class soils. A significant part of the Third-class soils is covered by roads, houses, and other farm buildings, however. The greater part of the crop-adapted soil is widely distributed in small tracts that have difficult accessibility in many cases. Many of the narrow colluvial areas that would otherwise be suitable for crops are heavily shaded by the steep forested slopes.

Soils of this association support a relatively small farm population. Practically all of the farms are of the subsistence or part-time type, although there are a few small general or livestock farms. Soil management is generally at a fairly low level. About one-half of the area is cleared and used for crops or pasture or has been abandoned. The rest is chiefly in an oak-chestnut forest.

The small acreage of crop-adapted soils and the large extent of relatively poor pastureland greatly limit the choice of farm enterprises. Proper use of soil is difficult and management is very exacting. The upland soils are difficult to work and conserve, and the application of the needed amendments is very difficult.

8. PORTERS-TUSQUITEE-CLIFTON ASSOCIATION

The Porters-Tusquitee-Clifton association is principally on the remnants of an old, highly dissected plain in the mountainous southeastern part of the county. It is mainly hilly and steep and has very irregular slopes and a very irregular drainage pattern (pl. 12, *A*). Small covelike areas are not uncommon. The uplands consist mainly of hilly and steep Porters soils, but there is a very small acreage of Clifton soil. Tusquitee soils and Stony colluvium, Tusquitee soil material, are on the colluvial areas at the base of slopes and along the narrow drainageways. The association occupies about 2.4 percent of the county.

About 85 percent of the association consists of Fourth- and Fifth-class soils in about equal proportions. The rest consists largely of Second- and Third-class soils. The Second- and Third-class soils are confined largely to the colluvial-alluvial areas and consequently are in relatively small generally long and narrow tracts widely distributed throughout the soil association area. A significant part of these soils is covered by roads, houses, and other farm buildings. Some of the less steep Porters and Clifton soils apparently can be used for crops under a high level of management.

Two-thirds or more of the soils of this association have been cleared of their oak-chestnut forest and are being used for crops and pasture. A general type of farming on a small scale, usually with a crop specialty or livestock as an important source of income, is most common. A considerable number of farms, however, are of the type producing mainly for home use. Soils of this association support the most prosperous farming community in the mountainous part of the county. Soil use and management are highly variable but are inadequate to maintain a high productivity on most farms.

Farmers in this area have the problem of trying to use the soils according to their capabilities and still supply the needs for specific crops or pasture. The average farm has a small acreage of crop-adapted soils, which is generally used intensively for crop production.

This acreage, however, is generally not adequate to meet the needs for feed crops, and farmers must practice the intensity of soil management necessary for the successful use of Fourth-class soils for crops. Soil management under such conditions is very exacting. Contour stripcropping and proper fertilization have proved effective in maintaining the hilly and steep soils under more intensive use. Fertilization and liming, however, are difficult on this type of terrain. It is generally desirable to follow a type of farming that makes maximum use of pasture and requires a minimum of crops.

9. MATNEY-RAMSEY ASSOCIATION

The Matney-Ramsey association, which consists of high mountain crests or plateaus, covers about 0.4 percent of the county. The areas occupied by this soil association are moderately dissected and the relief is prevailingly rolling to hilly but includes many steep slopes. Matney soils are on most of the rolling and nonstony hilly areas; Ramsey soils are on the steep and stony hilly areas.

About 25 percent of this association consists of Third-class soils, 25 percent of Fourth-class soils, and 50 percent of Fifth-class soils. The Third-class soils occur in fairly large areas, are easy to work and conserve, but are low in natural fertility. With adequate fertilization, good pastures can be established and maintained.

Practically all of the Third- and Fourth-class soils have been cleared and used for crops and pasture. The Fifth-class soils are in hemlock-hardwood or oak-chestnut forest. The farming is of the type that produces almost exclusively for use of the farm family. Soil use and management are at a low level.

The principal farm and soil management problems are traceable in most cases to the limited amounts of crop- and pasture-adapted land on each farm.

10. RAMSEY ASSOCIATION

The Ramsey is a large, rough, mountainous association consisting chiefly of hilly, steep, or very steep Ramsey soils or Stony rough land, Ramsey soil material (pl. 12, *B*). There is a very small acreage of Matney soils on the smoother mountain crests, and a small acreage of Jefferson and Hayter soils on the colluvial areas. These soils, however, are largely isolated by large areas of Fifth-class Ramsey soils. It is estimated that more than 95 percent of the association is in Fifth-class soils. Practically all of the association is in forest—yellow pine-hardwoods, upland hardwoods, or oak-chestnut forest types. This is presumably the best use for most of the soils, although they are unproductive of forest. This association covers about 42.6 percent of the county.

11. RAMSEY-JEFFERSON ASSOCIATION

The Ramsey-Jefferson association, which covers about 7.2 percent of the county, consists of parallel mountain ridges and narrow intervening high-lying valleys. Steep Ramsey soils and Stony rough land, Ramsey soil material, are on most of the uplands; hilly and steep stony Jefferson or Hayter soils are on practically all of the colluvial land in the valleys. A small acreage of Cobbly alluvium, Hamblen and Sequatchie soil materials, and a very small acreage of Staser and Hamblen soils occur on the narrow stream bottoms in the center of the

valleys. Some areas of stony rolling Jefferson soil are found in the broader valleys.

Fourth- and Fifth-class soils are dominant; practically all the uplands are occupied by Fifth-class soils. Third-class soils, which occupy 10 to 15 percent of the colluvial areas, are widely distributed in the valleys. The areas of soil suitable for crops or pasture are small and, in many places, isolated by larger areas of Fifth-class soils.

The soils of this association support a very small farm population, mainly on small farms producing for household use. Practically all of the uplands and more than half of the valley areas are still in forest—predominantly yellow pine-hardwood. Forest products are a source of income for many of the farmers.

The small acreage of crop-and pasture-adapted soils largely precludes the commercial type farm; in fact, the very limited size of the areas makes it difficult to use these according to their capabilities. Soil maintenance is difficult.

12. MASADA-CONGAREE ASSOCIATION

The Masada-Congaree is a small association that includes the first bottoms and terraces of the Watauga River. It covers only about 0.2 percent of the total county; but owing to its high proportion of productive crop soils, it is important to the agriculture of the county.

The low and very narrow first bottoms consist chiefly of Congaree soils. Some areas of these bottoms are very stony, and all are subject to periodic flooding. The larger part of the association consists of undulating to rolling, medium-high terraces. Masada soils are on most of the terraces. Second-class soils are the most extensive in this association, and the rest are Third- or Fourth-class. The Fourth-class soils consist mainly of very stony alluvial material on the stream bottoms.

The small general type of farm is common in this area. The farms include a part of the Elliber-Hagerstown-Greendale association in most places. The soils on these farms are suited to a wide variety of crops; and although naturally productive of most crops, they respond well to good management. Practically all of the area has been cleared and is being used moderately intensively for crop production. The pastures are generally on the adjacent upland slopes. Management requirements on soils of this association are not very exacting and farmers have a wide choice of enterprises.

MORPHOLOGY AND GENESIS OF SOILS

Soil is the product of soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil development have acted on the soil material (*8*). The effects of climate on soil development depend not only on such factors as temperature, rainfall, and humidity, but also on the physical characteristics of the soil or soil material and the relief, which in turn strongly influences drainage, aeration, runoff, erosion, and exposure to sun and wind.

Climate and vegetation are active factors of soil genesis. They act on the parent material accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The nature of the parent material also affects the kind of profile that can be formed and in extreme cases dominates it entirely. Finally, time is needed for the changing of the parent material into a soil profile. The time needed for horizon differentiation may be much or little, but some time is always required. Usually a long time is required for the development of distinct horizons.

The interrelationships among the factors of soil formation are complex, and it is therefore hard to isolate the effects of any one with certainty. It is possible to find some areas where four of the factors are constant or nearly so, and in such areas the effects of the fifth factor can be partially evaluated. Even in such places the measurements of the one factor are approximations of the actual effects. It is convenient, however, to discuss the individual factors and their effects in soil formation, but the reader should remember that it is the interaction of these factors rather than their simple sum that determines the nature of the soil profile.

The purpose of this section is to present the outstanding morphological characteristics of the soils of Johnson County and to relate them to the factors of soil formation. Physical and chemical data are limited for these soils, and the discussion of soil genesis and morphology is correspondingly incomplete. The first part of the section deals with the environment under which the soils exist; the second, with specific soil series and the part environment has played in determining the morphology of the soils comprising the series.

FACTORS OF SOIL FORMATION AS RELATED TO JOHNSON COUNTY

The parent materials of the soils of Johnson County may be considered in two broad classes: (1) Material residual from the weathering of rocks in place and (2) materials transported by water or gravity and laid down as unconsolidated deposits of clay, silt, sand, and large rock fragments. Materials of the first class are related directly to the underlying rocks from which they were derived; materials of the second class, to the soils or rocks from which they were washed or fell.

The parent materials formed in place consist of the residuum of igneous, sedimentary, and metamorphic rocks; and the properties of these rocks are strongly reflected in many of the properties of the soils that have developed from them. The sedimentary rock include dolomitic limestone, shale, siltstone conglomerate, and sandstone; and the metamorphic rocks include quartzite, gneiss, and schist (*4*, *3*). Geologically, the rocks are very old. The sedimentary rocks were formed in the Cambrian period; the igneous and metamorphic rocks, including crystalline gneiss and schist, were formed in the Archeozoic (*4*). Most of the rock formations are folded and faulted and generally have a decided dip.

Certain soils of the county developed from residual materials are generally associated with particular rock formations or parts of rock formations. The Hagerstown and Elliber soils are chiefly from the weathered materials of dolomite or dolomitic limestone of the Shady dolomite formation (*3*). The Hagerstown soils are from the purer

dolomitic limestone member of this formation, whereas the Elliber soils are from a highly siliceous member. The Teas and Litz soils are associated with the Rome formation. In this county, this formation consists of red shale and siltstone, some green shale, and some dolomite. The dolomite usually occurs in thin widely spaced beds. The Teas soils are derived from the red shale, and the Litz mainly from the green shale.

The Ramsey and Matney soils have formed largely from residual material of quartzite, shale, siltstone, conglomerate, and sandstone. They are associated with the basal clastic group of the Lower Cambrian series, which consists of the oldest Paleozoic rocks in northeastern Tennessee (*3*). The group is divided into the Unicoi, Hampton, and Erwin formations, and the soils have formed over rocks in all three formations. The most characteristic rock of the Unicoi formation is coarse-grained arkosic quartzite. All gradations are present between highly feldspathic and vitreous quartzite. In the lowest part of the Unicoi the quartzite grades into conglomerate, which contains rounded pebbles, quartz, feldspar, and fragments of pre-Cambrian rocks. The formation includes much sandy shale, siltstone, and fine-grained sandstone. The Hampton formation is composed of alternating beds of clay shale, siltstone, vitreous quartzite, and arkosic quartzite. The Erwin formation consists of interbedded layers of white vitreous quartzite, ferruginous quartzite, siltstone, and shale. The quartzite beds constitute only a small part of it, and a much larger part is formed by siltstone and shale.

Parts of the Ramsey and Matney soils are browner than typical for these series because they have formed from the Helenmode member of the Erwin formation (*3*). This member includes soft arkosic sandstones, calcareous shale, and glauconitic material.

The Ashe, Perkinsville, Porters, and Clifton soils are derived from weathered products of rocks of the Archean period. These rocks are classified as Cranberry granite, Beech granite, and Roan gneiss (*8*). The Ashe and Perkinsville soils are associated principally with the Cranberry and Beech granites. Cranberry granite—mainly granite and granite gneiss—consists of granite of varying color and texture and schists and granitoid gneisses derived from the granite. The granite is an igneous rock composed of quartz and orthoclase and plagioclase feldspar, with biotite, muscovite, and occasionally hornblende as additional minerals. Beech granite—massive and schistose in structure—consists of coarse granite, frequently porphyritic but seldom fine grained. The minerals composing the rock are orthoclase and plagioclase feldspar, quartz, biotite, and very little muscovite.

The Porters and Clifton soils have formed mainly from residual products of Roan gneiss. This rock formation consists of hornblende gneiss, hornblende schist, and diorite, with some interbedded mica schist and gneiss, dikes of diabase, and a little gneissoid granite. The mica schist and gneiss are composed of quartz, muscovite, a little biotite, and more or less feldspar. The hornblende schist makes up most of the formation and is interbedded with hornblende gneiss throughout. The schist beds consist almost entirely of hornblende; they contain a very small amount of biotite, feldspar, and quartz.

The kinds of transported rock materials are reflected in some of the properties of the soils that are derived from them. Soils of the Masada, Congaree, Chewacla, and Tusquitee series are formed from trans-

ported materials derived mainly through the decomposition of granite, gneiss, and schist. The soil of the Dunning series is derived from materials from quartzite, shale, siltstone, conglomerate, and sandstone, together with some calcareous material from shale or limestone. The Greendale soil is composed of materials transported from uplands underlain by cherty dolomitic limestone. The soils of Whitwell, Tyler, and Jefferson series are formed from transported materials that weathered from quartzite, shale, siltstone, conglomerate, and sandstone, although some material of the Whitwell and Tyler soils comes from dolomite. The Hayter, Sequatchie, Staser, Hamblen, and Prader soils are formed from materials washed from uplands underlain by quartzite, shale, siltstone, conglomerate, and sandstone but generally include some materials from dolomite, dolomitic limestone, or calcareous shale. The Camp and Shouns soils are almost entirely from materials washed from uplands underlain by red shale.

Although a rather consistent relationship exists between the kinds of parent materials and some of the properties of soils, other soil properties, especially those of regional significance from the standpoint of soil genesis, cannot be correlated with kinds of parent materials and must be attributed to other factors.

Johnson County has a humid temperate climate with cool summers (see section on Climate, page 6). The mountain areas have cooler summers and lower average temperatures throughout the year than the valleys. Precipitation is also heavier and includes considerably more snow. The high rainfall throughout the county favors rather intense leaching of soluble materials and colloidal materials downward in the soil. The soil is frozen for only short periods, especially in the valleys, and to only shallow depths, and the weathering and translocation of materials is therefore further intensified. In the mountainous areas, the chemical reactions in the soils are slowed by the lower temperatures; and leaching is also retarded, since the soils are frozen for longer periods and to greater depths than in the valleys.

Within any climatic zone, climate is the cause of many of the outstanding characteristics that the well-developed, well-drained soils have in common. Apparently, however, the differences in climate within this county are not of sufficient magnitude to account for the broad differences that exist among the soils. The climate over the larger part of the county has characteristics of the climate of both the Red-Yellow Podzolic and Gray-Brown Podzolic soil regions. Consequently, Red-Yellow Podzolic, and Gray-Brown Podzolic soils are intimately associated, and differences in such factors as parent material, drainage, and age appear to have been of primary importance in determining the great soil groups to which the soils belong.

Trees, shrubs, grasses, other herbaceous plants, micro-organisms, earthworms, and various other forms of plant and animal life live on and in the soil and are active agencies in the soil-forming process. The nature of the changes that these various biological forces bring about depends, among other things, on the kinds of life and the life processes peculiar to each. The kinds of plants and animals that live on and in the soil are determined by environmental factors, including climate, parent material, relief, age of the soil, and the associated organisms. The influence of climate is most apparent, though not always most important, as a determinant of the kinds of macroflora

that grow on the well-drained, well-developed soils. In this way climate exerts a powerful indirect influence on the morphology of soils.

A hardwood or mixed pine and hardwood forest was on most of the well-drained, well-developed soils. White pine-hardwoods, yellow pine-hardwoods, and hemlock-hardwoods forest types were common in the valleys and on surrounding mountain slopes. Oak-chestnut or upland hardwood forest types were most extensive in the mountains. There were probably differences in the density of stands, the relative proportion of species, and the associated ground cover. However, taking the area as a whole, the forests appear to have been relatively uniform, except for those in the valleys, and it is doubtful if any of the marked differences in properties among the well-drained, well-developed soils are the direct result of differences in vegetative cover.

Most of the trees that grow in this area are moderately deep to deep feeders on plant nutrients in the soil. They are chiefly deciduous trees. The leaves range considerably among species in content of various plant nutrients, but in general the quantities of bases and phosphorus returned to the soil in leaves of deciduous trees are somewhat higher than in those of coniferous trees. Essential plant nutrients are thus returned to the upper part of the soil from the lower part and retard the depleting action of percolating waters.

Much organic material is added to the soil in the form of dead leaves, roots, and entire plants. Most of it is added to the A horizon, where it is acted upon by micro-organisms, earthworms, and other forms of life and by direct chemical reactions. In Johnson County the rate of decomposition of such materials is rather rapid as a result of favorable temperature and moisture conditions, favorable character of the organic material itself, and presumably favorable micropopulation of the soil. Organic material does not accumulate on well-drained sites in the valleys to the extent that it does in cooler regions of the mountains or in the poorly drained sites in the valleys.

Little is known of the micro-organisms, earthworms, and other population of the soils of the county. This population is important in soil genesis, but the effects have not been adequately determined generally.

The well drained, well-developed soils have been formed under relatively similar conditions of climate and vegetation. It is on these soils that climate and vegetation have had the maximum influence with the minimum of modification by relief. As a result, the soils developed from various kinds of parent materials have many properties that are common to all.

In virgin conditions all of the well-drained, well-developed soils have a surface layer of organic debris in varying stages of decomposition. All have dark-colored A_1 horizons. A_2 horizons are lighter in color than either the A_1 or the B. The B horizon is generally uniformly colored yellow, brown, or red and is heavier textured than the A_1 or A_2. The C horizon is variable in color and texture among the different soils, but it is usually light red or yellow mottled with gray or brown.

The properties mentioned above are common to all well-developed, well-drained soils that have been subjected to similar conditions of climate and vegetation. They are, therefore, common to soils of zonal

extent, and all soils that exhibit them can be called zonal soils. Zonal soils are members of one of the classes of the highest category in soil classification and are defined as those great groups of soils having well-developed soil characteristics that reflect the influence of the active factors of soil genesis—climate and living organisms (*8*).

In areas in Johnson County where the parent materials have been in place a long time and have not been subject to extreme conditions of relief or of the parent material itself, the soils that have developed have the characteristics of zonal soils. In areas where the parent material has been in place only a short time, as in the case of recently transported materials, the soils have poorly defined or no genetic horizons. These soils are young and have few or none of the properties of zonal soils and are therefore called azonal soils. Azonal soils are members of a second class of the highest category of soil classification and are defined as a group of soils without well-developed soil characteristics because their youth or their condition of parent material or relief prevents the development of normal soil profile characteristics (*8*).

The azonal soils are characterized by A_1 horizons that are moderately dark to very dark and apparently moderately to fairly high in organic-matter content; by the absence of a zone of illuviation, or B horizon; and by parent material that is usually lighter than the A_1 horizon in color and similar to, lighter than, or heavier than the A_1 horizon in texture. They may be referred to as A-C soils because of the absence of a B horizon.

The relief of soils ranges from nearly level to very steep. On some steep areas where the quantity of water that percolates through the soil is relatively small and where the large amount and rapid rate of runoff contribute to relatively rapid geologic erosion, the soils are young. The materials are constantly renewed or mixed, and the changes brought about by vegetation and climate may be so slight that the soils are essentially A–C soils. These soils are also azonal soils.

On some nearly level areas where both internal and external drainage are restricted or where geological erosion is very slow, soils whose materials have been in place a long time have certain well-developed profile characteristics that zonal soils do not have. Such soils are associated geographically with the zonal soils and are called intrazonal soils. They are defined as soils with more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief or parent material or age over the normal effects of climate and vegetation (*8*). The properties of such soils in this area are generally the result of level relief influenced greatly by the character of the parent material and the kinds of vegetation that grow in such environments.

Soils of each of the three broad classes—zonal, azonal, and intrazonal—may be derived from similar kinds of parent materials. Within any one of those classes in this area, major differences among soils appear to be closely related to differences in the kinds of parent materials. The thickness of soils over the rock from which they were derived is partially determined by the resistance of the rock to weathering, the volume of residue after weathering, and the rate of geologic erosion. The chemical and physical nature of the parent material modifies the rate and direction of chemical changes that re-

sult from climate and vegetation. The kind of parent material also exerts a pronounced influence on the kinds of vegetation that grow on the soil.

Rocks have also contributed to differences among soils through their effects on relief. The rocks of most of Johnson County are very old formations that are folded and faulted. The present relief is probably largely a product of geologic weathering and erosion of those formations; the higher lands are capped by more resistant rocks, whereas the valleys are underlain by the less resistant rocks (*1*).

Streams in the ridges and mountains generally have steeper gradients than those in the valleys. As a result of faster stream cutting and greater relief from the stream floors to the dividing ridge crests, most of the soils of the ridges and mountains have steeper slopes than those of the valleys. The character of the rocks has thus contributed indirectly to the properties of some soils through relief.

The internal drainage of soils of nearly level relief in the limestone areas is exceptionally good as a result of good subterranean drainage through caverns and crevices in the sharply dipping rocks. This excellent subterranean drainage in the areas underlain by limestone counteracts the usual effects of gentle relief on drainage. It allows the nature of the parent rock to dominate local differences among the well-developed, well-drained soils derived from residual materials—soils that are subject to similar forces of climate and vegetation in this area.

CLASSIFICATION OF SOILS

Table 20 classifies the soil series of Johnson County according to soil orders and great soil groups and gives the source and kinds of parent materials, relief, and age for each series. Study of this table will aid in understanding the genetic relationships of the soils of the area.

TABLE 20.—*Classification of the soil series of Johnson County, Tenn., by higher categories, and factors that have contributed to differences in soil morphology* [1]

ZONAL SOILS

Great soil group and series	Relief	Parent material	Time [2]
Gray-Brown Podzolic soils:		Residuum from the weathering of—	
Hagerstown	Rolling to steep	Dolomitic limestone	Long.
Elliber	do	Cherty dolomitic limestone.	Do.
Matney	Rolling to hilly	Quartzite, shale, siltstone, conglomerate, and sandstone.	Do.
Perkinsville	Hilly	Granite, granite gneiss, and schist.	Do.
		Old alluvium mainly from—	
Sequatchie	Undulating to rolling.	Quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Medium.

See footnotes at end of table.

TABLE 20.—*Classification of the soil series of Johnson County, Tenn., by higher categories, and factors that have contributed to differences in soil morphology* [1]—Continued

ZONAL SOILS—Continued

Great soil group and series	Relief	Parent material	Time [2]
Gray-Brown Podzolic soils—Con.		Old alluvium mainly from—Con.	
Whitwell	Undulating	Quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Medium.
		Old colluvium and local alluvium chiefly from—	
Hayter	Undulating to steep.	Quartzite, shale, siltstone, conglomerate, and sandstone; some limestone or calcareous shale.	Medium.
Shouns	Rolling to hilly	Red shale	Do.
Tusquitee	do	Granite, gneiss, and schist	Do.
Porters [3]	Hilly to steep	Residuum from the weathering of mica gneiss and mica schist, with some granite, hornblende gneiss, hornblende schist, and diorite.	Short to medium.
Red-Yellow Podzolic soils:			
Red members:			
Clifton	Hilly	Residuum from the weathering of hornblende gneiss, hornblende schist, and diorite, with some interbedded mica schist and mica gneiss.	Long.
Masada	Undulating to hilly.	Old alluvium mainly from granite, gneiss, and schist.	Do.
Yellow member:			
Jefferson	Rolling to steep	Old colluvium and local alluvium mainly from quartzite, shale, siltstone, conglomerate, and sandstone.	Medium to long.

INTRAZONAL SOILS

Planosols:			
Tyler	Nearly level; some depressional.	Old alluvium mainly from quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Very long.

See footnotes at end of table.

TABLE 20.—*Classification of the soil series of Johnson County, Tenn., by higher categories, and factors that have contributed to differences in soil morphology* [1]—Continued

Great soil group and series	Relief	Parent material	Time [2]
INTRAZONAL SOILS—Continued			
Low-Humic Gley soils:			
Prader	Nearly level; many areas depressional.	Recent alluvium mainly from quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Very short.
Humic Gley soils:			
Dunning	Nearly level; some depressional.	Recent alluvium from quartzite, shale, siltstone, conglomerate, and sandstone, influenced by calcareous material from shale or the underlying limestone.	Do.
AZONAL SOILS			
Lithosols:		Residuum from the weathering of—	
Teas	Rolling to very steep.	Red shale that contains thin lenses of dolomite.	Short to medium.
Litz	do	Green shale, mainly, with thin lenses of dolomite.	Do.
Ramsey	Hilly to very steep.	Quartzite, shale, siltstone, conglomerate, and sandstone.	Do.
Ashe	do	Granite, granite gneiss, and schist.	Do.
Alluvial soils:		Recent alluvium mainly from—	
Staser	Nearly level	Quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Very short.
Hamblen	do	do	Do.
Congaree	do	Granite, gneiss, and schist, mainly.	Do.
Chewacla	do	do	Do.
		Local alluvium and colluvium from—	
Greendale	Gently sloping	Cherty dolomitic limestone.	Short to medium.
Camp	do	Red shale, mainly	Do.

[1] Inasmuch as climate and vegetation are relatively uniform, they account for the broad differences in the soils in only a few instances and are therefore not shown in this table.

[2] Length of time that the material has been in place as indicated by the degree of profile development.

[3] The Porters is a lithosolic Gray-Brown podzolic series.

GRAY-BROWN PODZOLIC SOILS

Gray-Brown Podzolic soils comprise a zonal group of soils having a comparatively thin organic covering and organic-mineral layers over a grayish brown leached A horizon that rests upon an illuvial B horizon. The soils have developed under deciduous forest in a temperate moist climate. They have a surface covering of leaf litter, usually from deciduous trees—a dark, thin mild (only slightly or moderately acid) humus, somewhat mixed with mineral soil. Under the litter is a grayish-brown crumb-structured loamy A horizon, followed by a light grayish-brown or grayish-yellow A_2 horizon, and then by a moderately heavy blocky structured yellowish-brown, brown, brownish-yellow, or reddish-brown B horizon that becomes lighter colored with depth. The total depth of the solum varies considerably but seldom exceeds 4 feet. Podzolization is the main process in the development of these soils (*8*).

Hagerstown series

The soils of the Hagerstown series have developed from dolomitic limestone that is apparently lower in soluble impurities, particularly silica, than the rocks underlying the Elliber soils. They are generally somewhat shallower over bedrock, darker red or brown throughout the profile, and more fertile than the Elliber soils; and they have less steep relief in many places. The climate under which they have developed is similar, but the vegetation, especially the ground cover, is more dense. They have a dark-colored A horizon, which indicates a high content of organic matter. Since they are relatively very productive soils, it is reasonable to expect that they supported a luxuriant vegetation, and as a natural result have a darker A horizon.

These soils are moderately subject to erosion when cultivated, and many areas have a truncated profile as a result of erosion. They are more erosive than the Elliber soils on similar slopes. They are medium to strongly acid and are generally better supplied with bases than the Elliber soils. It is probable that the major differences between the two series are directly or indirectly the result of differences between the parent materials.

The following is a typical profile of Hagerstown silt loam:

A_1 0 to 2 inches, dark-brown or dark grayish-brown, mellow, very friable silt loam that has a soft, fine to medium crumb structure; high in organic matter.

A_2 2 to 12 inches, dark reddish-brown (5YR 3/3) to brown (7.5YR 4/4) friable silt loam with a medium crumb structure.

B_1 12 to 18 inches, reddish-brown (5YR 4/4) moderately friable silty clay with a moderate medium blocky structure.

B_2 18 to 32 inches, red (2.5YR 4/8) firm silty clay with a strong medium blocky structure; a few small dark concretions and small chert fragments.

B_3 32 to 48 inches, red (2.5YR 4/8) to yellowish-red firm or very firm silty clay or clay; structure particles larger but somewhat less distinct than in layer above; chert fragments more common and less completely weathered.

C 48 to 60 inches +, yellowish-red (5YR 5/8) very firm silty clay or clay mottled with yellow and pale brown; considerably more chert fragments than in other horizons.

Elliber series

Soils of the Elliber series have developed from materials weathered from dolomitic limestone that is high in insoluble materials, chiefly

silica. The silica is largely in the form of chalcedonic chert, but locally jasperoids have contributed to the parent materials. The soils of the Elliber series commonly occupy higher positions and have steeper slopes than the Hagerstown soils. They are deeper, less fertile, less erosive, and more cherty.

The parent materials of the Elliber soils differ from those of the Hagerstown soils in that they contain a greater amount of insoluble materials. The lower susceptibility to erosion of these soils and the greater volume of residue from weathering of the rocks apparently result in a thicker mantle of unconsolidated rock material over bedrock for the Elliber soils than for the Hagerstown. This mantle probably protects the bedrock from rapid weathering; and this, together with the fact that cherty dolomite weathers more slowly than high-grade limestone or dolomitic limestone, may largely account for the higher positions of the Elliber soils and the resultant steeper slopes. The Elliber soils are strongly acid throughout the profile.

Following is a description of a typical profile of Elliber cherty silt loam:

A_1 0 to 1 inch, dark-gray silt loam stained dark with organic matter.
A_2 1 to 8 inches, light brownish-gray (10YR 6/2, dry) to dark grayish-brown (10YR 4/2, moist) very friable cherty silt loam.
B_1 8 to 18 inches, brownish-yellow (10YR 6/8) to reddish-yellow (7.5YR 7/8) friable cherty silty clay loam; weak medium blocky structure.
B_2 18 to 34 inches, brownish-yellow (10YR 6/6) friable cherty silty clay loam or silty clay; weak to moderate medium blocky structure.
C 34 to 60 inches +, reddish-yellow (7.5YR 6/8) friable silty clay loam coarsely mottled with yellow, gray, and brown; layer becomes increasingly cherty with greater depth; bedrock at a depth of 10 feet or more.

Matney series

The soils of the Matney series resemble the Perkinsville soils in most morphological characteristics and in genesis but differ in parent materials. The parent material has weathered from quartzite, shale, siltstone, conglomerate, and sandstone. Like the Perkinsville soils, these soils are at high altitudes on mountain crests or plateaus and have developed under a moist temperate climate with cool summers. They are probably less fertile and more acid than the Perkinsville soils. Many of the soils included in this series are darker colored than the profile described below. This variation is apparently due to a difference in parent rock. The parent material of these browner soils has weathered from a rock formation that includes soft arkosic sandstones, calcareous shale, and glauconitic materials.

A representative profile is as follows:

A_1 0 to 1 inch, dark grayish-brown loose loam stained with organic matter.
A_2 1 to 8 inches, pale-brown (10YR 6/3) to brown (7.5YR 4/2) very friable loam with a weak fine crumb structure.
A_3 8 to 12 inches, pale-brown (10YR 6/3) friable heavy loam.
B_2 12 to 30 inches, yellowish-brown (10YR 5/6) friable clay loam with a weak medium blocky structure.
C 30 to 36 inches, brownish-yellow (10Y6/6) friable clay loam mottled with gray; contains numerous disintegrating rock fragments.

Perkinsville series

The soils of the Perkinsville series have developed from the residuum of granite, granite gneiss, and schist. The parent materials are similar to those of the Ashe soils. Geological erosion has

been less rapid on the Perkinsville soils than on the Ashe, mainly because of their milder slopes, and deeper profiles with more distinct horizons have developed. The soils apparently supported a poor forest growth, and as a result the surface layers are low in organic matter. The soils of this series are strongly acid.

A representative profile is as follows:

A_1 0 to 2 inches, dark grayish-brown loose loam stained with organic matter.
A_2 2 to 8 inches, dark grayish-brown to brown (10YR 4/2–4/3, moist) to pale-brown (10YR 6/3, dry) very friable loam with a weak fine crumb structure.
A_3 8 to 12 inches, very pale-brown (10YR 7/4) friable loam.
B_2 12 to 26 inches, yellowish-brown (10YR 5/6) friable clay loam of weak medium blocky structure.
B_3 26 to 32 inches, yellowish-brown (10YR 5/4) friable clay loam; some disintegrating rock fragments.
C 32 to 44 inches, brownish-yellow (10YR 6/6) clay loam mottled with brownish gray and yellow and containing numerous disintegrating rock fragments.

Sequatchie series

The soils of the Sequatchie series are on low stream terraces or second bottoms along the larger creeks and rivers. They have developed from parent materials similar to those of the generally closely associated Staser series, but they are older and have moderately well developed profiles. They have undulating to rolling relief. Development was under a hardwood forest and under climatic conditions similar to those of the other zonal soils of the valleys. Some of the materials from which the soils are derived were so recently deposited, however, that only weak profile development is apparent.

A representative profile of Sequatchie loam follows:

A_1 0 to 2 inches, dark grayish-brown (10YR 4/2) loose to very friable loam; a relatively large quantity of organic matter.
A_2 2 to 12 inches, brown (7.5YR 4/4) very friable loam; weak fine crumb structure.
B_2 12 to 30 inches, strong-brown (7.5YR 5/8) friable light clay loam; weak medium blocky structure.
C 30 to 42 inches +, strong-brown (7.5YR 5/6) very friable gritty loam mottled with gray, yellow, and brown; numerous cobbles.

Whitwell series

The soil of the Whitwell series is closely associated with the Sequatchie soils, and like those soils it has developed from old stream alluvium washed from materials weathered mainly from quartzite, shale, siltstone, conglomerate, and some dolomite. It has developed under somewhat inferior drainage conditions that probably result partly from the generally milder slopes and partly from the high water table. The soil is imperfectly drained and grades toward Low-Humic Gley soils in characteristics.

A representative profile is as follows:

A_1 0 to 1 inch, dark-gray (10YR 4/1) very friable silt loam moderately high in organic matter.
A_2 1 to 8 inches, brown (10YR 4/3) friable silt loam.
B_1 8 to 16 inches, brownish-yellow to yellowish-brown (10YR 6/6–5/6) friable silt loam to heavy silt loam that has a weak fine crumb structure.
B_2 16 to 30 inches, brownish-yellow (10YR 6/6) friable silty clay loam mottled with yellow, light gray, and strong brown; weak medium blocky structure.
C 30 to 48 inches +, friable silty clay loam mottled with gray, yellow, and strong brown.

Hayter series

Soils of the Hayter series have developed from old colluvium and local alluvium. The colluvium was derived from slopes underlain by quartzite, shale, siltstone, conglomerate, and sandstone and consists of sandstone and quartzite fragments and other rock debris. In most areas it contains some calcareous material derived from limestone or calcareous shale, or is influenced by calcareous drainage waters from such material. Most of the colluvial materials have been in place long enough for the development of the normal Gray-Brown Podzolic soil profile of the area.

Hayter soils differ from Jefferson soils, with which they are associated, in having a much browner profile and apparently in containing a much larger quantity of decomposed organic matter. In many places the brown color of the Hayter soils has apparently been inherited from parent materials washed from the brown variation of Ramsey and Matney soils. Some of the soils included with the Hayter series receive frequent deposits of colluvial or local alluvial material; they are young soils with little profile development and would be properly classified as Alluvial soils. These young soils have been mapped in the Barbourville series in other East Tennessee counties. The Hayter soils are medium acid.

A representative profile is as follows:

A_1 0 to 3 inches, very dark grayish-brown (10YR 3/2) loose loam stained with organic matter.
A_2 3 to 12 inches, dark-brown to brown (10YR 4/3) friable silt loam with a moderate medium crumb structure.
B_1 12 to 18 inches, brown (10YR 5/3) to yellowish-brown (10YR 5/6) friable light clay loam; fine blocky structure.
B_2 18 to 30 inches, strong-brown (7.5YR 5/6) friable clay loam or silty clay loam; weak medium blocky structure.
B_3 30 to 36 inches, yellowish-brown (10YR 5/8) friable clay loam.
C 36 to 60 inches, light yellowish-brown (10YR 6/64) to yellowish-brown (10YR 5/8) friable clay loam or sandy clay loam mottled with yellow and gray; some quartzite pebbles and cobbles.

Shouns series

The soils of the Shouns series resemble the Hayter soils in many morphological characteristics. They differ in source of parent material and in having a dusky-red color and finer textured firmer subsoils. They occupy colluvial positions and have formed from materials washed mainly from Teas soils on the adjacent slopes. The parent material is similar to that of the Camp soil. The soils are older, however, and have well-developed zonal profiles, whereas the Camp soil is a young Alluvial soil. The difference in age is apparently the cause of the differences in these soils.

A representative profile is as follows:

A_1 0 to 2 inches, very dark grayish-brown (10YR 3/2) very friable silt loam high in content of organic matter.
A_2 2 to 12 inches, dusky-red (10R 5/2–3/3) friable silt loam with a weak medium crumb structure.
B_2 12 to 32 inches, strong-brown (7.5YR 5/6) friable to firm heavy silty clay loam or silty clay with a moderate medium blocky structure.
B_3 32 to 40 inches, strong-brown (7.5YR 5/8) slightly friable silty clay; structure less distinct than in B_2 horizon.
C 40 to 48 inches +, yellowish-brown (10YR 5/8) friable silty clay that contains many red and yellow shale fragments.

Tusquitee series

The soils of the Tusquitee series occupy colluvial positions and have formed from materials washed from the adjacent slopes, largely from Porters and Ashe soils. The depth to bedrock is generally greater and moisture conditions are more favorable for heavy vegetative growth than on the associated Perkinsville soils of the uplands. The forest apparently included a larger proportion of sugar maple, tulip-poplar, basswood, and birch. The soils have thicker dark-colored surface layers than the Perkinsville and are more variable in degree of profile development. In some places they receive frequent deposits of colluvial or local alluvial material, are young, and have little profile development. The soils of this series are medium acid.

A representative profile is as follows:

A_1 0 to 4 inches, very dark grayish-brown (10YR 3/2) loose loam stained dark with organic matter.

A_2 4 to 12 inches, dark-brown (7.5YR 3/2) friable loam with a strong medium crumb structure.

B_2 12 to 32 inches, brown (7.5YR 4/4) friable clay loam with a weak fine blocky structure.

B_3 32 to 40 inches, strong-brown (7.5YR 5/8) friable light clay loam; lighter in texture and contains more stones than B_2 horizon.

C 40 to 60 inches, strong-brown (7.5YR 5/6) stony clay loam mottled with gray and yellow.

Porters series

The Porters soils are on steep and, to a small extent, hilly mountain uplands. The materials from which they have formed were somewhat similar to those of the Ashe soils, but the parent rock was probably somewhat less acidic. The parent rock includes mica gneiss and mica schist, and to a lesser extent granite, hornblende gneiss, hornblende schist, and diorite. These soils are browner and less yellowish than the Ashe soils, probably because of more iron oxide in the parent material. They are more fertile and apparently support a more luxuriant vegetation that has resulted in darker surface layers. Because in many places the soils mapped in this series have relatively weakly developed textural profiles, they are classed as lithosolic Gray-Brown Podzolic soils.

A representative profile of Porters loam is as follows:

A_1 0 to 3 inches, very dark grayish-brown (10YR 3/2) loose loam stained dark with organic matter.

A_2 3 to 10 inches, brown or dark-brown (7.5YR 4/2–4/4) very friable loam with a moderate medium crumb structure.

C_1 10 to 24 inches, strong-brown (7.5YR 5/8) friable loam; weak fine blocky structure.

C_2 24 to 40 inches, yellowish-brown (10YR 5/8) to strong-brown (7.5YR 5/8) loam or clay loam containing a large quantity of gray disintegrating rock fragments.

D 40 inches +, granitic bedrock.

RED-YELLOW PODZOLIC SOILS

Soils of the Red-Yellow Podzolic great soil group are well-developed, well-drained acid soils having thin organic (A_0) and organic-mineral (A_1) horizons over a light-colored bleached (A_2) horizon, underlain by a red, yellowish-red, or yellow more clayey (B) horizon. Parent materials are more or less siliceous. Coarse reticu-

late streaks or mottles of red, yellow, brown, and light gray are characteristic of deep horizons of Red-yellow Podzolic soils where parent materials are thick.

Red-Yellow Podzolic soils have developed under deciduous, coniferous, or mixed forest in warm-mesothermal to tropical, humid to prehumid climates. In cultivated areas the A_0 and A_1 horizons are incorporated in the plow soil; and in many places erosion has removed all or nearly all the A horizon, leaving the B exposed. The clay fraction is dominated by kaolinite, but contains considerable free ferric oxides or hydroxides and in places a relatively small proportion of aluminum hydroxide. Hydrous mica and montmorillonite are present in the clay fraction of some of the soils but are not considered typical. In any specific parent material, the reticulate streaks generally occur higher in the profiles with yellow B horizons than in those with red B horizons; and in a few members of the group, especially the very sandy ones, the streaked material may be absent.

Since this county is transitional between the Red-Yellow and Gray-Brown Podzolic zones, the Red-Yellow Podzolic soils would be expected to occur on the lower mountain slopes or in the valleys where the temperatures are higher. This is generally true, but the two great soils groups are highly intermixed. Where the two groups occur at similar elevations, the Red-Yellow Podzolic soils have been in place for a longer time.

The Red-Yellow Podzolic great soil group consists of red members and yellow members. The red members have thin organic and organic mineral layers over a yellowish-brown leached layer that rests upon an illuvial red horizon. The yellow members have thin organic and organic-mineral layers over a pale-yellow leached layer that rests on a yellow horizon. The soil-forming processes involved in the development of both members are laterization and podzolization.

The causes of the development of the pronounced color differences between the red members and the yellow members are not known. It appears, however, that the yellow members of the county are generally associated with parent materials either lower in bases or less well-drained internally than are the parent materials of the red members. In some areas it appears that the yellow members developed under a vegetative cover that had a greater number of pines and a less luxuriant and somewhat different undergrowth. In Johnson County two red members and one yellow member occur. The red members have developed in the mountain portion, mainly from basic rocks, whereas the yellow member has developed on reworked materials—colluvium and local alluvium.

RED MEMBERS

The red members of the Red-Yellow Podzolic great soil group are represented in Johnson County by the Clifton and Masada series.

Clifton series

The soil of the Clifton series has developed from weathered products of dark-colored basic igneous rocks on hilly relief in the mountain uplands. The material is mainly derived from hornblende gneiss, hornblende schist, and diorite, together with material weathered from interbedded mica schist and mica gneiss. The soil occupies hilly relief in mountain uplands. It is in small areas closely associated with the Per-

kinsville, which is a Gray-Brown Podzolic soil, and with Porters and Ashe soils, which are, respectively, lithosolic Gray-Brown Podzolic soils and Lithosols. The Clifton soil has developed under similar climatic conditions but is formed from materials weathered from more basic rocks. In most places it has well-developed characteristics of the red members of the Red-Yellow Podzolic great soil group. Differences between this soil and the associated soils are apparently due to differences in parent material. The soil of the Clifton series is strongly acid to very strongly acid.

An uneroded profile is as follows:

A_1 0 to 3 inches, very dark grayish-brown (10YR 3/2) loose to very friable loam.
A_2 3 to 12 inches, reddish-brown (2.5YR 4/4) to dark reddish-brown (2.5YR 3/4) friable clay loam with a weak medium crumb structure.
B_1 12 to 20 inches, red (2.5YR 4/8) moderately friable clay loam or silty clay loam; weak fine to medium blocky structure.
B_2 20 to 30 inches, red (2.5YR 4/8) friable heavy clay loam or silty clay loam with a moderate medium blocky structure.
B_3 30 to 42 inches, red (2.5YR 4/6) moderately friable heavy clay loam; structure less distinct than in above layer.
C 42 to 48 inches +, yellowish-red (5YR 5/8) heavy clay loam mottled with light yellowish brown.

Masada series

Soils of the Masada series are formed from old alluvium that consists mainly of material derived from granite, gneiss, and schist, but in most places includes an admixture of material from quartzite, shale, siltstone, conglomerate, and sandstone. The relatively high fertility and favorable moisture conditions appear to have encouraged a heavy forest growth that resulted in a relatively high content of organic matter in the upper layers. These soils are medium to strongly acid.

A representative profile is as follows:

A_1 0 to 2 inches, very dark grayish-brown (10YR 3/2) loose silt loam stained with organic matter.
A_2 2 to 12 inches, brown to dark-brown (7.5YR 4/4) friable silt loam with a weak medium crumb structure.
B_2 12 to 36 inches, yellowish-red (5YR 5/6) friable silty clay loam with a moderate medium blocky structure.
C 36 inches +, yellowish-red (5YR 5/8) friable silty clay loam or clay loam mottled with gray.

YELLOW MEMBERS

The yellow member of the Red-Yellow Podzolic great soil group in Johnson County is the Jefferson series.

Jefferson series

The soils of the Jefferson series are on foot slopes and benches at the bases of mountain slopes. Their parent materials are old colluvium and local alluvium washed chiefly from the Ramsey soils on the adjoining uplands and consisting of materials derived largely from quartzite, shale, siltstone, conglomerate, and sandstone. The Jefferson soils have rolling to steep relief and are well drained. In most places they have developed under mixed forests of hardwood and pine. The climate was essentially that of the other zonal soils of the valleys. In some areas shown as Jefferson, the soils frequently receive additions of colluvial or local alluvial material. These are young

soils with little profile development and might properly be classified as Alluvial soils. The materials, however, are low in bases and easily eluviated.

A representative profile of Jefferson loam follows:

A_1 0 to 1 inch, dark-gray (10YR 4/1) loose fine sandy loam stained with organic matter.
A_2 1 to 8 inches, grayish-brown (10YR 5/2) very friable loam.
B_2 8 to 30 inches, brownish-yellow (10YR 6/6) to yellowish-brown (10YR 5/6) friable clay loam with a weak fine blocky structure.
C 30 to 48 inches +, reddish-yellow (7.5YR 6/8) friable sandy clay loam mottled with gray, red, and brown; contains many quartzite cobbles or rock fragments 2 to 4 inches across.

PLANOSOLS

Planosols are of an intrazonal group of soils with eluviated surface horizons underlain by B horizons more strongly illuviated, cemented, or compacted than those of associated normal soils. They were developed upon a nearly level upland under grass or forest vegetation in a humid or subhumid climate (*8*).

In Johnson County the Tyler series has been classed in the Planosols great soil group. It is nearly level or slightly depressional and is poorly drained. The pan layer of the Tyler soil is relatively dense or compacted, but this layer varies in degree of development.

Climatic conditions were similar to those under which the zonal soils developed, but the Planosols are moister and less well aerated. Some differences probably existed between the kinds of vegetation on the Planosols and Red-Yellow Podzolic or Gray-Brown Podzolic soils, although deciduous forest was on all. From the standpoint of profile development, the Planosols appear to be older than either the Gray-Brown Podzolic or Red-Yellow Podzolic soils, but the causes of development of older soils are not known. The relief of the Planosols is such that geological erosion would be slow, but that factor alone is not the cause of their formation. The soil material itself is not older in years than that of associated zonal soils of similar relief. It is possible that relatively dense layers in the parent material and underlying rock strata caused slow internal drainage. This, combined with slow external drainage and unusual siltiness of the parent material, resulted in abnormal concentration or cementation of the material in or below the illuvial horizon.

Tyler series

The soil of the Tyler series is derived from materials similar to those of the Whitwell and Sequatchie soils, but it is more poorly drained than either of these soils. It developed under slow internal and external drainage on nearly level or slightly depressional stream terraces from old alluvium consisting of materials weathered from quartzite, shale, siltstone, conglomerate, sandstone, and some dolomite, although shale possibly was the principal contributor. The differences between the Tyler and the Whitwell soil are chiefly due to differences in drainage, although the Tyler soil probably did develop from somewhat siltier materials underlain by more slowly permeable material.

A representative profile of Tyler silt loam is as follows:

A_1 0 to 1 inch, gray to dark-gray very friable silt loam.
A_2 1 to 10 inches, gray (10YR 5/1) friable floury silt loam.
B_2 10 to 18 inches, pale-yellow (2.5Y 7/4) friable heavy silt loam to silty clay loam mottled with light gray; weak medium blocky structure.
Pan 18 to 40 inches, light gray (5Y 7/1) compact silty clay loam to clay mottled with yellow; breaks into irregular fragments along very indistinct cleavage lines.
C 40 to 48 inches +, light-gray (5Y 7/1) friable silty clay loam.

LOW-HUMIC GLEY SOILS

Low-Humic Gley soils, an interzonal group, are defined as imperfectly to poorly drained soils with very thin surface horizons, moderately high in organic matter, over mottled gray and brown gleylike mineral horizons (*7*). The soil-development process is gleyzation. In this county only the Prader series has the characteristics of Low-Humic Gley soils.

Prader series

The Prader soil is poorly drained and is predominantly gray or gray mottled throughout. The surface soil is a silt loam, but the material is somewhat heavier below a depth of about 10 inches.

HUMIC GLEY SOILS

Humic Gley soils, an intrazonal group, are defined as poorly drained to very poorly drained hydromorphic soils with dark-colored organic-mineral horizons of moderate thickness underlain by mineral gley horizons (*7*). The soil-development process involved in their formation is gleyzation. In this county the Dunning series is the only representative of the Humic Gley group.

Dunning series

The soil of the Dunning series is young and poorly drained. It occurs in stream bottoms and has not developed genetically related horizons. It consists of recent alluvium derived from uplands underlain by quartzite, shale, siltstone, conglomerate, and sandstone. This material, however, is apparently greatly influenced by the underlying limestone or other calcareous material. The parent material is similar to that of the Prader soil, but principally the Dunning soil differs in being darker in color and higher in organic matter. The darker color of the Dunning soil is apparently due to the high content of organic matter accumulated under swampy conditions.

A representative profile is as follows:

1. 0 to 6 inches, dark-gray (10YR 3/1) to black (2.5Y 2/0) mucky silt loam containing partially decayed moss, leaves, and twigs.
2. 6 to 18 inches, dark grayish-brown (2.5Y 4/2) to black (2.5Y 2/0) friable silt loam.
3. 18 to 30 inches +, very dark-gray (10YR 3/1) friable silty clay loam faintly mottled with light yellowish brown.

LITHOSOLS

Lithosols are an azonal group of soils having no clearly expressed soil morphology and consisting of a freshly and imperfectly weathered mass of rock fragments. They are largely confined to steeply sloping land (*8*). These soils occupy positions where geologic erosion is relatively rapid and consist of materials that are relatively easily eroded.

As a result, material is removed from the surface or so mixed that soil-forming processes have not acted on it long enough to produce well-defined genetic soil properties. As mapped these soils may include small areas of zonal soils.

Teas series

The soils of the Teas series are derived from the residuum of a red shale interbedded in most places with thin lenses of dolomite. The soils have formed on characteristically rounded or domelike hills and have predominantly hilly and steep relief. Natural erosion apparently has been almost rapid enough to keep pace with soil development. The soils are therefore shallow, contain numerous shale fragments, and normally lack distinct profile development, although weakly developed profiles are included in the mapping unit. These soils differ from the Litz soils chiefly in having a reddish color inherited from the parent rock. The Teas soils are strongly acid.

A representative profile is as follows:

A_1 0 to 1 inch, dark reddish-gray (10R 3/1) loose silt loam stained dark with organic matter.

A_2 1 to 8 inches, weak-red to dusky-red (2.5YR 4/2–3/2) friable shaly silt loam.

C 8 to 20 inches, light reddish-brown to reddish-brown (5YR 6/4–5/4) friable shaly silty clay loam coarsely mottled with yellow, especially in the lower part; moderate medium to coarse blocky structure; numerous partially weathered shale fragments.

D 20 inches +, red shale bedrock.

Litz series

The soils of the Litz series are shallow soils in complex association with Teas soils on prevailingly hilly and steep uplands. They formed mainly from residuum weathered from green shale or shale that contains an occasional thin lens of dolomite. Natural erosion has removed the soil material almost as fast as formed; consequently, the soils are shallow or very shallow, contain numerous shale fragments, and have very weakly developed profiles. They are lighter in color, more acid, and less fertile than the Teas soils. The differences between Teas and Litz soils are apparently due to differences in parent material.

A representative profile for Litz soils:

A_1 0 to 1 inch, gray (10YR 5/1) loose shaly silt loam stained with organic matter.

A_2 1 to 8 inches, light yellowish-brown (10YR 6/4) friable silt loam.

C 8 to 20 inches, brownish-yellow (10YR 6/6) to yellow (10YR 7/6) friable shaly silty clay loam mottled with gray and yellow; very shaly and highly mottled in the lower part.

D 20 inches +, bedrock; acid yellow shale with thin widely spaced lenses of dolomite.

Ramsey series

The soils of the Ramsey series have developed from materials weathered from quartzite, shale, siltstone, conglomerate, and sandstone. They were chiefly under hardwood forests, although locally there is considerable pine in the present forest cover. The soils are on hilly to very steep mountain slopes, but only a relatively small part is on very steep slopes.

The rocks under the Ramsey soils weather slowly. Parent material is therefore formed slowly, and it is removed by geological erosion almost as rapidly as formed. The soils are consequently shallow and

do not have well-developed profiles. They are low in plant nutrients and organic matter and support a very poor forest. The soils are strongly acid.

A representative profile is as follows:

A_1 0 to 1 inch, gray (10YR 5/1) loose very friable loam stained with a moderate amount of organic matter.
A_2 1 to 6 inches, brown (10YR 5/3) to light yellowish-brown (10YR 6/4) very friable stony loam.
A_3 6 to 14 inches, brownish-yellow (10YR 6/6) friable stony loam.
C 14 to 24 inches, pale-brown (10YR 6/3) friable stony fine sandy loam containing thin layers of soft disintegrating rock.
D 24 inches +, quartzite bedrock.

Ashe series

The Ashe soils are on steep, very steep, and, to some extent, hilly mountain uplands. They have formed from loamy or sandy parent materials weathered from granite, granite gneiss, and schist rocks similar to those underlying the Perkinsville soils. Their native vegetation consisted of a hardwood forest mixed in places with pine and hemlock. Drainage is excessive. The soil material is removed by geologic erosion almost as rapidly as it is formed; consequently, the Ashe soils either lack profile development or have thin weakly developed profiles. In many places they have sufficiently well-developed profiles to be classed as lithosolic Gray-Brown Podzolic soils.

A representative profile is as follows:

A_1 0 to 2 inches, dark-gray (10YR 4/1) loose loam stained dark with organic matter.
A_2 2 to 10 inches, grayish-brown (10YR 5/2) friable loam with a weak fine crumb structure.
C_1 10 to 20 inches, light yellowish-brown (10YR 6/4) to brownish-yellow (10YR 6/6) friable heavy loam.
C_2 20 to 40 inches, light-brown (7.5YR 6/4) loam coarsely mottled with gray; mixed with disintegrating rock material.
D 40 inches +, granite bedrock.

ALLUVIAL SOILS

Alluvial soils are an azonal group of soils developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the material by soil-forming process (*8*). In Johnson County these soils are on first bottoms along streams and on foot slopes. They have nearly level or gently sloping relief and medium or slow internal drainage. All have weakly developed or incipient profiles having little or no genetically related horizon development. The properties of the soil are closely related to the alluvial parent material.

Alluvial soils derived from similar parent material may differ in drainage, and some differences in properties exist because of those drainage differences. The soil series have been differentiated mainly on the basis of properties associated with good, imperfect, or poor drainage.

Staser and Hamblen series

The soils of the Staser and Hamblen series are derived from young general alluvium consisting of quartzite, shale, siltstone, conglomerate, sandstone, and in some places dolomite. These soils have formed on

nearly level flood plains under a deciduous forest vegetation. The differences between these soils are closely associated with differences in drainage. All are young and do not have developed profiles. In general they are higher in bases, phosphorus, nitrogen, and organic matter than the associated soils of the uplands.

The Staser soil is well drained and consists of brown or dark-brown loose fine sandy loam to a depth of about 14 inches. Below this depth the material is a yellowish-brown or brown friable heavy loam or fine sandy loam. It may be mottled with gray below a depth of about 36 inches. The soil is slightly acid in most places.

The Hamblen soil is imperfectly drained and is a grayish-brown or brown very friable loam to depths of 14 to 18 inches. The material below this depth range is highly mottled and generally heavier in texture. This difference in texture may be partially due to soil-forming processes, but it is more likely due to deposition.

Congaree and Chewacla series

The soils of the Congaree and Chewacla series are young soils of the first bottoms and were formed largely from alluvium composed of material derived mainly from granite, gneiss, and schist. This material has not been in place long enough to develop genetically related horizons. Differences between the Congaree and Chewacla soils are closely associated with drainage; differences between them and the Staser soil are due mainly to differences in the character of the parent alluvium.

The Congaree soil is well drained and free of mottlings to a depth of about 24 inches or more. The surface layer, extending to a depth of about 12 inches, is dark-brown or brown very friable fine sandy loam. Next in the profile is yellowish-brown or brown friable fine sandy loam that continues to a depth of about 30 inches. In most places this is underlain by light-colored stratified coarse- and fine-textured materials.

The Chewacla soils are imperfectly drained and consist of grayish-brown or brown loose loam to a depth of 12 to 18 inches. The material below this is highly mottled and varies considerably in texture.

Greendale series

Soil of the Greendale series occurs on foot slopes, along intermittent drains, and on alluvial-colluvial fans. It has formed from materials washed from the adjacent slopes. In this county most of the material is from Elliber soils, formed on uplands from material derived from cherty dolomitic limestone. This material is highly siliceous, strongly acid, and low in fertility. Most of the soil is young and has an indistinct or weakly developed profile.

A representative profile is as follows:

1. 0 to 2 inches, dark-gray (10YR 4/1) mellow silt loam stained dark with organic matter.
2. 2 to 12 inches, brown (10YR 4/3–5/3) friable silt loam.
3. 12 to 20 inches, yellowish-brown (10YR 5/6) friable silt loam or light silty clay loam.
4. 20 to 32 inches, brownish-yellow (10YR 6/6) friable silt loam or silty clay loam faintly mottled with gray.
5. 32 inches +, brownish-yellow (10YR 6/6) friable silty clay loam or clay loam mottled with gray.

Camp series

The soil of the Camp series is reddish colored and well drained to imperfectly drained. It was formed at the base of slopes from recent local alluvium or colluvium washed chiefly from Teas soils, which are derived mainly from red shale. This material has not been in place long enough for the soil to develop genetically related horizons, and the profile is indistinct or weakly developed. Differences between this soil and the associated Shouns soils, which have formed from similar parent material, are due chiefly to differences in age. The Camp soil is slightly to medium acid.

A representative profile is as follows:

1. 0 to 12 inches, dusky-red (2.5YR 3/2) friable silt loam.
2. 12 to 30 inches, reddish-brown to weak-red (2.5YR 4/4–4/2) friable silt loam or silty clay loam.
3. 30 to 48 inches, yellowish-red (5YR 5/6) silty clay loam mottled with yellow, gray, and brown.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examining, classifying, and mapping of soils in the field. The soil scientist walks over the area at intervals not more than one-quarter mile apart and bores into the soil with an auger or digs holes with a spade. Each such boring or hole shows the soil to consist of several distinctly different layers, called horizons, which collectively are known as the soil profile. Each of these layers is studied carefully for the things about it that affect plant growth.

The color of each layer is noted. The darkness of the topmost layer is usually related to its content of organic matter; streaks and spots of gray, yellow, and brown in lower layers generally indicate poor drainage and poor aeration.

Texture, or the content of sand, silt, and clay in each layer, is determined by the feel of the soil when rubbed between the fingers and is checked by mechanical analysis in the laboratory. Texture has much to do with the quantity of moisture the soil will hold available to plants, whether plant nutrients or fertilizers will be held by the soil in forms available to plants or will be leached out, and how hard the soil may be to cultivate.

Structure, or the way the soil granulates, and the number of pores or open spaces between soil particles determine the permeability or perviousness of the soil and consequently the ease with which plant roots penetrate and water enters it.

Consistence, or the tendency of the soil to crumble or to stick together, determines the degree of difficulty that will be encountered in keeping the soil open and porous under cultivation. Consistence covers such soil characteristics as hardness, friability, plasticity, stickiness, compactness, toughness, and cementation.

Surface soil ordinarily refers to the surface layer, which is usually 5 to 10 inches thick. The layer just below the surface soil is the subsoil; the layer beneath the subsoil, the substratum.

The kind of rocks and the parent soil material that develops from these rocks affect the quantity and kind of plant nutrients the soil may have naturally. Simple chemical tests show how acid the soil may be. The depth to bedrock or to compact layers is determined. The quan-

tity of gravel or rocks that may interfere with cultivation, the steepness and kind of slope, the quantity of soil lost by erosion, and other external features are observed.

On the basis of all these characteristics, soil areas that are much alike in the kind, thickness, and arrangement of their layers are mapped as one soil type. Some soil types are separated into two or more phases. For example, if a soil type has slopes that range from 2 to 12 percent, the type may be mapped in two phases, an undulating phase (2 to 5 percent slopes), and a rolling phase (5 to 12 percent slopes); or a soil that has been eroded in places may be mapped in two or more phases, an uneroded or normal phase (denoted by the name of the soil type only), an eroded phase, and perhaps a severely eroded phase. A soil type will be broken into phases primarily because of differences in the soil other than those of kind, thickness, and arrangement of layers. The slope of a soil, the frequency of outcropping bedrock, the extent of its erosion, or the artificial drainage used on the soil are examples of characteristics that might cause a soil type to be divided into phases.

Two or more soil types may have similar profiles; that is, the soil layers may be nearly the same, except that the texture, especially of the surface layer, will differ. As long as the other characteristics of the soil layers are similar, these soils are considered to belong in the same soil series. A soil series, therefore, consists of all the soil types, whether the number be only one or several, that except for texture—particularly the texture of the surface layer—are about the same in kind, thickness, and arrangement of layers.

The name of a place near where a soil series was first found is chosen as the name of the series. Thus, Sequatchie is the name of a deep, well-drained soil series found on water-laid deposits in Johnson County. Three types of the Sequatchie series are found—Sequatchie loam, Sequatchie cobbly loam, and Sequatchie silt loam. These differ in the texture of the surface soil, as their names show.

When very small areas of two or more kinds of soil are so intricately mixed that they cannot be shown separately on a map of the scale used, they are mapped together, and the areas of the mixture are called a soil complex. Teas-Litz silt loams, hilly phases, is a complex of Teas silt loam, hilly phase, and Litz silt loam, hilly phase, in Johnson County.

Areas, such as bare rocky mountainsides and stony colluvial areas, that have little true soil are not designated with series and type names but are given descriptive names, such as Stony rough land, Ashe and Porters soil materials; and Stony colluvium, Jefferson soil material.

The soil type, or where the soil type is subdivided, the soil phase, is the unit of mapping in soil surveys. It is the unit or the kind of soil that is most nearly uniform and has the narrowest range of characteristics. For this reason land use and soil management practices can be more definitely specified for it than for broader groups of soils that contain more variation. One can say, for example, that soils of the Hayter series need lime for alfalfa. But for Hayter loam, undulating phase, one can say that it has mild slopes and, in addition to needing lime, is suited to row crops grown in a rotation with small grain and hay. For Hayter stony loam, eroded hilly phase, one can say that it has slopes that fall more than 12 feet in 100, is hard to work

with heavy machinery, is easily eroded, and should be used principally for long-term hay or pasture. Both phases are included in the Hayter series.

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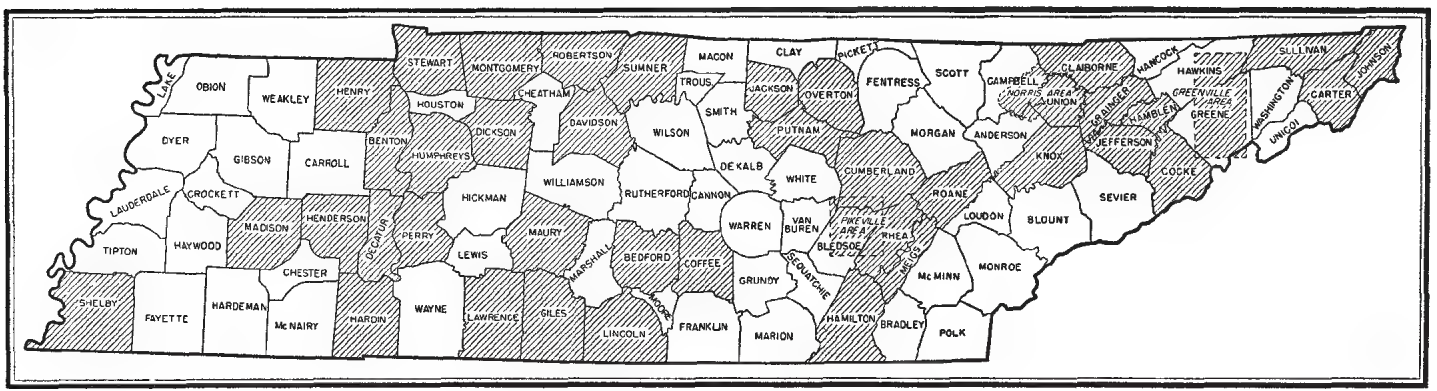
U. S. GOVERNMENT PRINTING OFFICE: 1956

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C.



Areas surveyed in Tennessee shown by shading.

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

LEGEND SHEET
JOHNSON COUNTY - TENNESSEE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

LEGEND

Aa — Ashe loam, eroded steep phase
Ab — Ashe loam, steep phase
Ac — Ashe stony loam, eroded hilly phase
Ad — Ashe stony loam, eroded steep phase
Ae — Ashe stony loam, hilly phase
Af — Ashe stony loam, steep phase
Ag — Ashe stony loam, very steep phase
Ca — Camp silt loam
Cb — Chewacla gravelly fine sandy loam
Cc — Chewacla loam
Cd — Clifton clay loam, eroded hilly phase
Ce — Cobbly alluvium, Hamblen and Sequatchie soil materials
Cf — Congaree fine sandy loam
Da — Dunning silt loam
Ea — Elliber cherty silt loam, eroded hilly phase
Eb — Elliber cherty silt loam, eroded rolling phase
Ec — Elliber cherty silt loam, eroded steep phase
Ed — Elliber cherty silt loam, hilly phase
Ee — Elliber cherty silt loam, steep phase
Ga — Greendale silt loam
Ha — Hagerstown silty clay loam, eroded hilly phase
Hb — Hagerstown silty clay loam, eroded rolling phase
Hc — Hagerstown silty clay loam, eroded steep phase
Hd — Hamblen loam
He — Hayter loam, eroded hilly phase
Hf — Hayter loam, eroded rolling phase
Hg — Hayter loam, hilly phase
Hk — Hayter loam, undulating phase
Hl — Hayter stony loam, eroded hilly phase
Hm — Hayter stony loam, eroded rolling phase
Hn — Hayter stony loam, eroded steep phase
Ho — Hayter stony loam, hilly phase
Hp — Hayter stony loam, rolling phase
Hr — Hayter stony loam, steep phase
Hs — Hayter stony loam, undulating phase
Ja — Jefferson loam, eroded rolling phase
Jb — Jefferson stony fine sandy loam, eroded rolling phase
Jc — Jefferson stony fine sandy loam, eroded steep phase
Jd — Jefferson stony fine sandy loam, hilly phase
Je — Jefferson stony fine sandy loam, rolling phase
Jf — Jefferson stony fine sandy loam, steep phase
Jg — Jefferson stony loam, eroded hilly phase
Jh — Jefferson stony loam, eroded rolling phase
Jk — Jefferson stony loam, eroded steep phase
Jl — Jefferson stony loam, hilly phase
Jm — Jefferson stony loam, rolling phase
Jn — Jefferson stony loam, steep phase
M — Made land
Ma — Masada silt loam, eroded hilly phase
Mb — Masada silt loam, eroded rolling phase
Mc — Masada silt loam, undulating phase
Md — Matney loam, eroded hilly phase
Me — Matney loam, eroded rolling phase
Mf — Mine pits
Pa — Perkinsville loam, hilly phase
Pb — Perkinsville loam, eroded hilly phase
Pc — Porters loam, eroded hilly phase
Pd — Porters loam, eroded steep phase
Pe — Porters loam, steep phase
Pf — Porters stony loam, eroded steep phase
Pg — Porters stony loam, steep phase
Ph — Prader silt loam
Ra — Ramsey stony loam, hilly phase
Rb — Ramsey stony loam, steep phase
Rc — Ramsey stony loam, very steep phase
Sa — Sequatchie cobbly loam, eroded rolling phase
Sb — Sequatchie cobbly loam, undulating phase
Sc — Sequatchie loam, undulating phase
Sd — Sequatchie silt loam, undulating phase
Se — Shouns silt loam, eroded hilly phase
Sf — Shouns silt loam, eroded rolling phase
Sg — Staser fine sandy loam
Sh — Stony colluvium, Jefferson soil material
Sk — Stony colluvium, Tusquitee soil material
Sl — Stony rough land, Ashe and Porters soil materials
Sm — Stony rough land, Elliber and Teas soil materials
Sn — Stony rough land, Ramsey soil material
Ta — Teas - Litz shaly silty clay loams, eroded hilly phases
Tb — Teas - Litz shaly silty clay loams, eroded rolling phases
Tc — Teas - Litz shaly silty clay loams, eroded steep phases
Td — Teas - Litz shaly silt loams, very steep phases
Te — Teas - Litz silt loams, hilly phases
Tf — Teas - Litz silt loams, steep phases
Tg — Teas shaly silty clay loam, eroded hilly phase
Th — Teas shaly silty clay loam, eroded steep phase
Tk — Teas shaly silt loam, steep phase
Tl — Tusquitee loam, eroded hilly phase
Tm — Tusquitee loam, eroded rolling phase
Tn — Tusquitee stony loam, eroded hilly phase
To — Tusquitee stony loam, eroded rolling phase
Tp — Tyler silt loam
Wa — Whitwell silt loam

SOIL MANAGEMENT GROUPING

MANAGEMENT GROUP 1
NEARLY LEVEL WELL-DRAINED TO IMPERFECTLY DRAINED SOILS OF THE BOTTOM LANDS

Chewacla loam
Chewacla gravelly fine sandy loam
Congaree fine sandy loam
Hamblen loam
Staser fine sandy loam

MANAGEMENT GROUP 2
UNDULATING SOILS OF THE COLLUVIAL SLOPES AND TERRACES

Camp silt loam
Greendale silt loam
Hayter loam, undulating phase
Made land
Masada silt loam, undulating phase
Sequatchie loam, undulating phase
Sequatchie silt loam, undulating phase
Whitwell silt loam

MANAGEMENT GROUP 3
ROLLING SOILS OF UPLANDS, COLLUVIAL SLOPES, AND TERRACES

Hagerstown silty clay loam, eroded rolling phase
Hayter loam, eroded rolling phase
Jefferson loam, eroded rolling phase
Masada silt loam, eroded rolling phase
Matney loam, eroded rolling phase
Shouns silt loam, eroded rolling phase
Tusquitee loam, eroded rolling phase

MANAGEMENT GROUP 4
UNDULATING AND ROLLING STONY SOILS OF COLLUVIAL SLOPES AND TERRACES

Hayter stony loam, eroded rolling phase
Hayter stony loam, rolling phase
Hayter stony loam, undulating phase
Sequatchie cobbly loam, eroded rolling phase
Sequatchie cobbly loam, undulating phase
Tusquitee stony loam, eroded rolling phase

MANAGEMENT GROUP 5
ROLLING STONY SOILS OF UPLANDS AND COLLUVIAL SLOPES

Elliber cherty silt loam, eroded rolling phase
Jefferson stony fine sandy loam, eroded rolling phase
Jefferson stony fine sandy loam, rolling phase
Jefferson stony loam, eroded rolling phase
Jefferson stony loam, rolling phase

MANAGEMENT GROUP 6
HILLY SOILS OF THE COLLUVIAL SLOPES AND TERRACES

Hayter loam, eroded hilly phase
Hayter loam, hilly phase
Masada silt loam, eroded hilly phase
Shouns silt loam, eroded hilly phase
Tusquitee loam, eroded hilly phase

MANAGEMENT GROUP 7
HILLY MEDIUM-TEXTURED SOILS OF THE UPLANDS

Matney loam, eroded hilly phase
Perkinsville loam, eroded hilly phase
Perkinsville loam, hilly phase
Porters loam, eroded hilly phase

MANAGEMENT GROUP 8
HILLY MODERATELY FINE-TEXTURED SOILS OF THE UPLANDS

Clifton clay loam, eroded hilly phase
Hagerstown silty clay loam, eroded hilly phase

MANAGEMENT GROUP 9
HILLY STONY AND VERY STONY SOILS OF THE COLLUVIAL SLOPES AND VERY STONY ALLUVIAL SOILS

Cobbly alluvium, Hamblen and Sequatchie soil materials
Hayter stony loam, eroded hilly phase
Hayter stony loam, hilly phase
Jefferson stony fine sandy loam, hilly phase
Jefferson stony loam, eroded hilly phase
Jefferson stony loam, hilly phase
Stony colluvium, Jefferson soil material
Stony colluvium, Tusquitee soil material
Tusquitee stony loam, eroded hilly phase

MANAGEMENT GROUP 10
HILLY STONY SOILS OF THE UPLANDS

Ashe stony loam, eroded hilly phase
Ashe stony loam, hilly phase
Elliber cherty silt loam, eroded hilly phase
Elliber cherty silt loam, hilly phase
Ramsey stony loam, hilly phase

MANAGEMENT GROUP 11
POORLY DRAINED SOILS OF THE BOTTOM LANDS AND TERRACES

Dunning silt loam
Prader silt loam
Tyler silt loam

MANAGEMENT GROUP 12
ROLLING TO STEEP SHALLOW SHALY SOILS

Teas shaly silt loam, steep phase
Teas shaly silty clay loam, eroded hilly phase
Teas shaly silty clay loam, eroded steep phase
Teas-Litz shaly silty clay loams, eroded hilly phases
Teas-Litz shaly silty clay loams, eroded rolling phases
Teas-Litz shaly silty clay loams, eroded steep phases
Teas-Litz silt loams, hilly phases
Teas-Litz silt loams, steep phases

MANAGEMENT GROUP 13
STEEP SOILS

Ashe loam, eroded steep phase
Ashe loam, steep phase
Hagerstown silty clay loam, eroded steep phase
Porters loam, eroded steep phase
Porters loam, steep phase

MANAGEMENT GROUP 14
STEEP STONY AND VERY STEEP SOILS, STONY ROUGH LANDS, AND MINE PITS

Ashe stony loam, eroded steep phase
Ashe stony loam, steep phase
Ashe stony loam, very steep phase
Elliber cherty silt loam, eroded steep phase
Elliber cherty silt loam, steep phase
Hayter stony loam, eroded steep phase
Hayter stony loam, steep phase
Jefferson stony fine sandy loam, eroded steep phase
Jefferson stony fine sandy loam, steep phase
Jefferson stony loam, eroded steep phase
Jefferson stony loam, steep phase
Mine pits
Porters stony loam, eroded steep phase
Porters stony loam, steep phase
Ramsey stony loam, steep phase
Ramsey stony loam, very steep phase
Stony rough land, Ashe and Porters soil materials
Stony rough land, Elliber and Teas soil materials
Stony rough land, Ramsey soil material
Teas-Litz shaly silt loams, very steep phases

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
Secondary roads, Trails
Railroads
Bridges, Ferry
Railroad crossings
Ford, Dam, Sawmill, Windmill
Boundary lines
School, Church, Creamery, Cemeteries
Boundary lines
Triangulation station, Boundary monument, Oil or Gas wells
U. S. Township and Section lines, Recovered corners
Forest fire station, Airway beacon, Oil or Gas tanks
Transmission line, Oil or Gas pipe line
Mine or Quarry, Gravel pit, Rock outcrop, Made land
Soil boundaries; Stony, Gravelly, and Cherty areas

RELIEF
(Printed in brown or black)

Contours, Depression contours
Prominent hills or Mountain peaks
Sand, Wash, Sand dunes
Bluff, Escarpment, Mine dumps

DRAINAGE
(Printed in blue)

Streams, Springs, Wells, Flowing wells
Lakes, Ponds, Intermittent lakes
Unsurveyed and Intermittent streams
Water pipe lines, Canals, Ditches, Flumes
Swamp, Salt marsh
Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

SPECIAL SYMBOLS

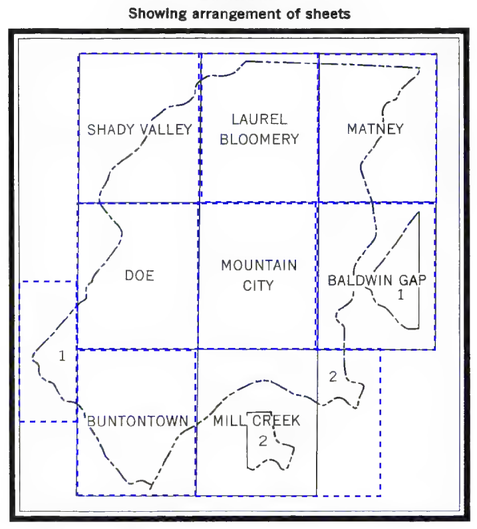
XX Areas too stony, cherty, or gravelly for cultivation.
U Uneroded areas

ACCELERATED EROSION
S Moderate sheet erosion
SS Severe sheet erosion
G Moderate gully erosion
GG Severe gully erosion
SG Moderate sheet and gully erosion
Gully

SINK HOLES AND DEPRESSIONS
Easy to cultivate across
Difficult to cultivate across
Containing water most or all of the time

The area covered by the Watauga Reservoir is shown by blue cross hatching.

DIAGRAM
Showing arrangement of sheets



See Shady Valley quadrangle for Soil Associations Map.

J. Kenneth Ableiter, Chief Soil Correlator.
W. H. Allaway, Chief Analyst, Soil Uses and Productivity.
W. S. Ligon, Principal Soil Correlator, Southern States.
Correlation and inspection by J. W. Moon, Principal Soil Scientist.
Soils surveyed 1942-45 by Ralph G. Leighty, U. S. Department of Agriculture, in Charge, F. R. Austin and Clifton Jenkins, Tennessee Agricultural Experiment Station.

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Map compiled and drafted for the Cartographic Division, Soil Conservation Service, by the Maps and Surveys Branch, Tennessee Valley Authority, from TVA topographic quadrangles.
Polyconic projection, 1927 North American datum.
10 000 foot grid based on Tennessee rectangular coordinate system.

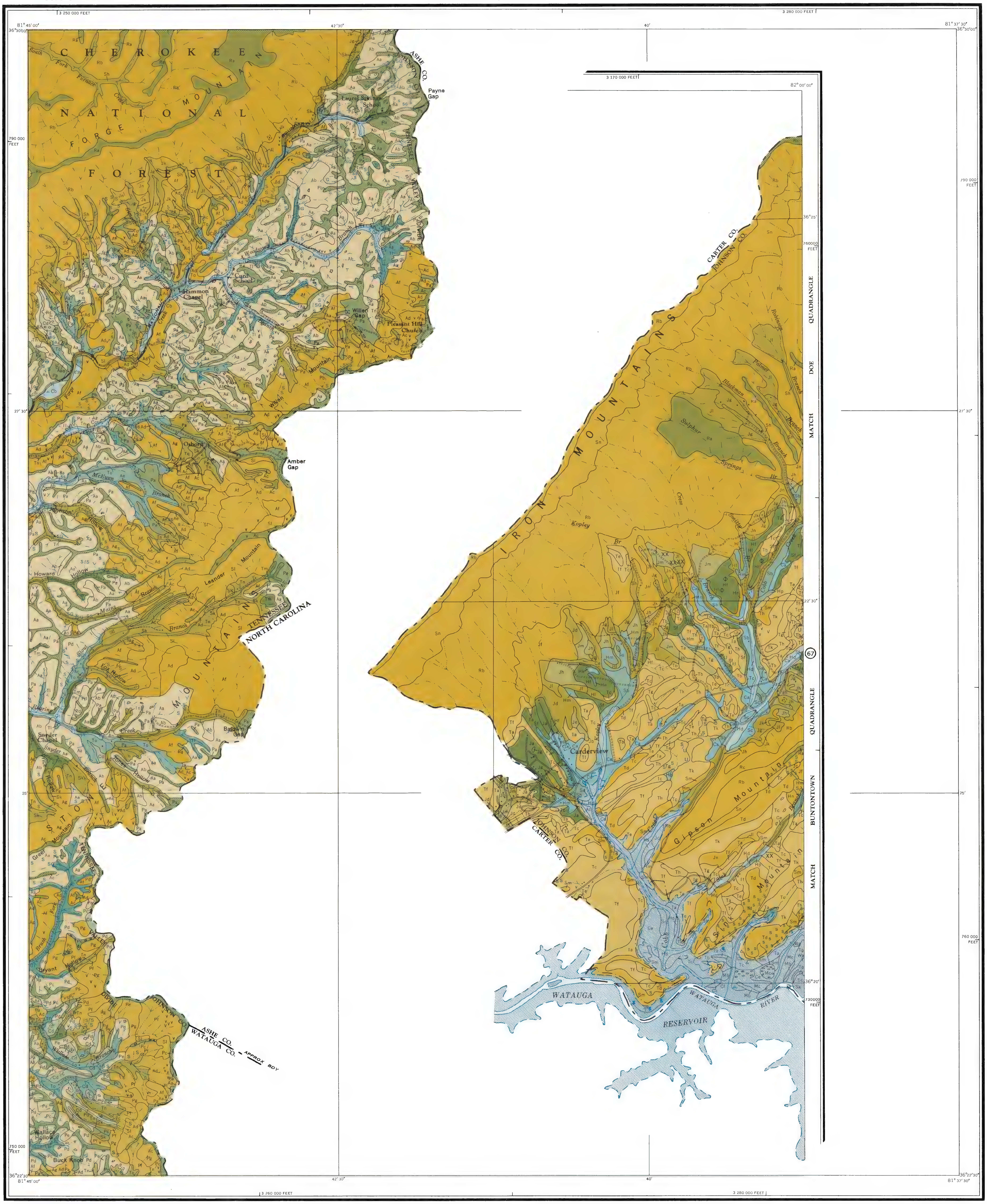
Soil	Map symbol	Management group [1]	Land class [2]	Dominant slope range	Surface soil color	Subsoil		Depth [3]	Nature of parent rock or parent material	Drainage
						Color	Consistence			
				Percent				*Feet*		
Ashe loam: Steep phase	AB	13	4	25–60	Grayish brown to pale brown	Light yellowish brown to brownish yellow.	Friable	2– 5	Granite, granite gneiss, and schist	Excessively drained.
Eroded steep phase	AA	13	4	25–60	Grayish brown to light yellowish brown.	do	do	2– 5	do	Do.
Ashe stony loam: Steep phase	AF	14	5	25–60	Grayish brown to pale brown	do	do	1– 5	do	Do.
Eroded steep phase	AD	14	5	25–60	Grayish brown to light yellowish brown.	do	do	1– 5	do	Do.
Hilly phase	AE	10	4	12–25	Grayish brown to pale brown	do	do	1– 5	do	Do.
Eroded hilly phase	AC	10	4	12–25	Grayish brown to light yellowish brown.	do	do	1– 5	do	Do
Very steep phase	AG	14	5	60+	Grayish brown to pale brown	do	do	1– 5	do	Do.
Camp silt loam	CA	2	2	2– 7	Dusky red to reddish brown	Reddish brown to weak red	do	2– 8	Local alluvium and colluvium mainly from red shale.	Well to imperfectly drained.
Chewacla loam	CC	1	2	0– 2	Grayish brown to brown	Light yellowish brown to brown, mottled.	do	2–10	Alluvium mainly from granite, gneiss, and schist.	Imperfectly drained.
Chewacla gravelly fine sandy loam	CB	1	3	0– 2	do	do	do	2–10	do	Do.
Clifton clay loam, eroded hilly phase	CD	8	3	12–25	Brown to dark reddish brown	Red to reddish brown	Loose	2– 6	Gneiss and schist (dark-colored) and diorite, mainly.	Well to excessively drained.
Cobbly alluvium, Hamblen and Sequatchie soil materials.	CE	9	4	0– 2	Grayish brown (see text description).	Brownish yellow (see text description).	Loose to very friable	3–15	Alluvium from quartzite, shale, siltstone, conglomerate, and sandstone.	Imperfectly to well drained.
Congaree fine sandy loam	CF	1	2	0– 2	Dark brown to brown	Brown to yellowish brown	Friable	2–10	Alluvium mainly from granite, gneiss, and schist.	Well drained.
Dunning silt loam	DA	11	4	0– 2	Dark gray or black	Very dark gray or dark gray, faintly mottled.	do	2–10	Alluvium mainly from quartzite, shale, siltstone, conglomerate, and sandstone, influenced by material from calcareous shale and the underlying limestone.	Poorly to imperfectly drained.
Elliber cherty silt loam: Hilly phase	ED	10	4	12–25	Light brownish gray to grayish brown.	Brownish yellow to reddish yellow.	do	5–20	Cherty dolomitic limestone	Well to excessively drained.
Eroded hilly phase	EA	10	4	12–25	Light brownish gray to brownish yellow or reddish yellow.	do	do	5–20	do	Do.
Eroded rolling phase	EB	5	3	5–12	Light brownish gray to brownish yellow.	do	do	5–20	do	Do.
Steep phase	EE	14	4	25–60	Light brownish gray to grayish brown.	do	do	5–20	do	Do.
Eroded steep phase	EC	14	5	25–60	Light brownish gray to brownish yellow.	do	do	5–20	do	Do.
Greendale silt loam	GA	2	2	2– 7	Light brownish gray to brown	Yellowish brown to brownish yellow.	do	2–10	Local alluvium and colluvium from cherty dolomitic limestone.	Well to imperfectly drained.
Hagerstown silty clay loam: Eroded rolling phase	HB	3	1	5–12	Dark brown to dark reddish brown or reddish brown.	Red to reddish brown	Firm	3–15	Dolomitic limestone	Well drained.
Eroded hilly phase	HA	8	3	12–25	Brown or reddish brown	do	do	3–15	do	Do.
Eroded steep phase	HC	13	4	25–60	do	do	do	3–12	do	Do.
Hamblen loam	HD	1	2	0– 2	Brown to grayish brown	Brown to light yellowish brown, mottled.	Friable or very friable	2– 4	Alluvium mainly from quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Imperfectly drained.
Hayter loam: Undulating phase	HK	2	1	2– 5	Brown or dark brown	Yellowish brown to strong brown.	Friable	3–10	Colluvium and local alluvium mainly from quartzite, shale, siltstone, conglomerate, and sandstone; some limestone or other calcareous influences.	Well drained.
Eroded rolling phase	HF	3	2	5–12	Dark brown or brown to yellowish brown.	do	do	3–10	do	Do.
Hilly phase	HG	6	3	12–25	Brown or dark brown	do	do	3–10	do	Do.
Eroded hilly phase	HE	6	3	12–25	Dark brown or brown to yellowish brown.	do	do	3–10	do	Do.
Hayter stony loam: Undulating phase	HS	4	2	2– 5	Brown or dark brown	do	do	3–10	do	Do.
Rolling phase	HF	4	3	5–12	do	do	do	3–10	do	Do.
Eroded rolling phase	HM	4	3	5–12	Dark brown, brown, or yellowish brown.	do	do	3–10	do	Do.
Hilly phase	HO	9	3	12–25	Dark brown or brown	do	do	3–10	do	Do.
Eroded hilly phase	HL	9	3	12–25	Dark brown, brown, or yellowish brown.	do	do	3–10	do	Do.
Steep phase	HR	14	4	25–60	Brown	do	do	3–10	do	Do.
Eroded steep phase	HN	14	4	25–60	Brown to yellowish brown	do	do	3–10	do	Do.
Jefferson loam, eroded rolling phase	JA	3	3	5–12	Grayish brown or light brownish gray.	Yellowish brown to brownish yellow or light yellowish brown.	do	4–20	Colluvium and local alluvium mainly from quartzite, shale, siltstone, conglomerate and sandstone; material washed or rolled chiefly from Ramsey soils on mountain uplands.	Do.
Jefferson stony fine sandy loam: Rolling phase	JE	5	3	5–12	do	do	do	3–15	do	Do.
Eroded rolling phase	JB	5	3	5–12	Grayish brown to light yellowish brown.	Brownish yellow	do	3–15	do	Do.
Hilly phase	JD	9	4	12–25	Grayish brown	Yellowish brown to brownish yellow or light yellowish brown.	do	3–15	do	Do.
Steep phase	JF	14	5	25–60	do	Yellowish brown to brownish yellow.	do	3–15	do	Well to excessively drained.
Eroded steep phase	JC	14	5	25–60	Grayish brown to light yellowish brown.	do	do	3–15	do	Do.
Jefferson stony loam: Rolling phase	JM	5	3	5–12	Grayish brown to light brownish gray.	Light yellowish brown to brownish yellow.	do	3–15	do	Well drained.
Eroded rolling phase	JH	5	3	5–12	Grayish brown to light yellowish brown.	Yellowish brown to brownish yellow.	do	3–15	do	Do.
Hilly phase	JL	9	4	12–25	Grayish brown to light brownish gray.	do	do	3–15	do	Do.
Eroded hilly phase	JG	9	4	12–25	Grayish brown to light yellowish brown.	do	do	3–15	do	Do.
Steep phase	JN	14	5	25–60	Grayish brown or light brownish gray.	do	do	3–15	do	Well to excessively drained.
Eroded steep phase	JK	14	5	25–60	Grayish brown to light yellowish brown.	do	do	3–15	do	Do.
Made land	M	2	2	2– 7	(A land type consisting of ore washings from mining operations. See text description.)		do	2– 5	Shale underlying Teas and Litz soils or cherty dolomitic limestone materials underlying Elliber soils.	Well drained.
Masada silt loam: Undulating phase	MC	2	1	2– 5	Dark brown to brown	Yellowish red	do	6–20	Alluvium mainly from granite, gneiss, and schist chiefly from Ashe and Porters soils.	Do.
Eroded rolling phase	MB	3	2	5–12	Brown to yellowish brown	do	do	6–20	do	Do.
Eroded hilly phase	MA	6	3	12–25	do	do	do	6–20	do	Do.
Matney loam: Eroded rolling phase	ME	3	3	5–12	Pale brown to brown	Yellowish brown to brownish yellow.	do	3– 5	Quartzite, shale, siltstone, conglomerate, and sandstone.	Do.
Eroded hilly phase	MD	7	3	12–25	Light brownish gray to brown	do	do	3– 5	do	Do.
Mine pits	MP	14	5		(A land type consisting of open excavations—mines and pits. See text description.)					
Perkinsville loam: Hilly phase	PB	7	3	12–25	Grayish brown to brown	Light brown to yellowish brown or brownish yellow.	Friable	3– 6	Granite, granite gneiss, and schist	Do.
Eroded hilly phase	PA	7	3	12–25	Grayish brown to yellowish brown.	Yellowish brown to brownish yellow.	do	3– 6	do	Do.
Porters loam: Steep phase	PE	13	4	25–60	Dark brown to brown	Strong brown to yellowish brown.	do	2– 5	Mica gneiss and mica schist; some granite, hornblende gneiss, hornblende schist and diorite.	Excessively drained.
Eroded steep phase	PD	13	4	25–60	Dark brown or brown to yellowish brown.	do	do	2– 5	do	Do.
Eroded hilly phase	PC	7	3	12–25	Brown to yellowish brown	do	do	2– 5	do	Excessively to well drained.
Porters stony loam: Steep phase	PG	14	5	25–60	Dark brown to brown	do	do	2– 5	do	Excessively drained.
Eroded steep phase	PF	14	5	25–60	Brown to yellowish brown	do	do	2– 5	do	Do.
Prader silt loam	PH	11	4	0– 2	Gray to dark gray, mottled	Gray, mottled	Friable, plastic when wet	4–10	Alluvium mainly from quartzite, shale, siltstone, conglomerate, sandstone, and dolomite, largely from Ramsey, Teas, and Litz soils.	Poorly drained.
Ramsey stony loam: Steep phase	RE	14	5	25–60	Brown to light yellowish brown.	Yellowish brown, brownish yellow, or pale brown.	Friable	1½– 3	Quartzite, shale, siltstone, conglomerate, and sandstone.	Excessively drained.
Hilly phase	RA	10	4	12–25	do	do	do	2– 3	do	Do.
Very steep phase	RC	14	5	60 +	do	do	do	1½– 3	do	Do.
Sequatchie loam, undulating phase	SC	2	2	2– 5	Brown to grayish brown	Yellowish brown to strong brown.	do	4–15	Alluvium mainly from quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Well drained.
Sequatchie cobbly loam: Undulating phase	SB	4	3	2– 5	Grayish brown or brown	do	do	4–15	do	Do.
Eroded rolling phase	SA	4	3	5–12	Grayish brown to yellowish brown.	do	do	4–15	do	Do.
Sequatchie silt loam, undulating phase	SD	2	1	2– 5	Dark grayish brown to brown	do	do	4–15	do	Do.
Shouns silt loam: Eroded rolling phase	SF	3	2	5–12	Dusky red to reddish brown or yellowish brown.	Strong brown to yellowish brown.	Friable to firm	3–10	Colluvium mainly from red shale; washed mostly from Teas soils.	Do.
Eroded hilly phase	SE	6	3	12–25	do	do	do	3–10	do	Do.
Staser fine sandy loam	SG	1	2	0– 2	Dark brown or brown	Yellowish brown or brown	Friable	4–15	Alluvium mainly from sandstone, quartzite, shale, siltstone, conglomerate, and some dolomite; washed chiefly from Teas, Litz, and Ramsey soils.	Do.
Stony colluvium: Jefferson soil material	SH	9	4	5–25	(A land type characterized by extreme stoniness. See text description).			2–10	Colluvium and alluvium mainly from quartzite, shale, siltstone, conglomerate, sandstone; washed or rolled from Ramsey soils.	Excessively drained.
Tusquitee soil material	SK	9	4	5–25	do			2–10	Colluvium and local alluvium from granite, gneiss, and schist; material washed or rolled mainly from Porters and Ashe soils.	Do.
Stony rough land: Ashe and Porters soil materials	SL	14	5	25–60+	do			0– 3	Granite, gneiss, and schist	Do.
Elliber and Teas soil materials	SM	14	5	25–60	do			0– 3	Cherty dolomitic limestone or shale	Do.
Ramsey soil material	SN	14	5	25–60+	do			0– 3	Quartzite, shale, siltstone, conglomerate, and sandstone.	Do.
Teas shaly silt loam, steep phase	TK	12	4	25–60	Weak red to dusky red	Light reddish brown to reddish brown.	Friable	2– 4	Red shale with thin lens of dolomite	Excessively to well drained.
Teas shaly silty clay loam: Eroded steep phase	TH	12	4	25–60	do	do	do	½– 3	do	Excessively drained.
Eroded hilly phase	TG	12	4	12–25	do	do	do	½– 3	do	Excessively to well drained.
Teas-Litz silt loams, hilly phases	TE	12	4	12–25	A complex association of shallow shaly soils. (See text description.)		do	2– 4	Red and green shales mainly, with thin lenses of dolomite.[4]	Do.
Teas-Litz shaly silty clay loams, eroded hilly phases.	TA	12	4	12–25	A complex association of eroded shallow shaly soils. (See text description.)		do	½– 3	do	Do.
Teas-Litz silt loams, steep phases	TF	12	4	25–60	A complex association of shallow shaly soils. (See text description.)		do	½– 3	do	Excessively drained.
Teas-Litz shaly silty clay loams, eroded steep phases.	TC	12	4	25–60	A complex association of eroded shallow shaly soils. (See text description.)		do	½– 3	do	Do.
Teas-Litz shaly silt loams, very steep phases.	TD	14	5	60+	A complex association of shallow shaly soils. (See text description.)		do	½– 3	do	Do.
Teas-Litz shaly silty clay loams, eroded rolling phases.	TB	12	3	5–12	A complex association of eroded shallow shaly soils. (See text description.)		do	2– 4	do	Well to excessively drained.
Tusquitee loam: Eroded rolling phase	TM	3	2	5–12	Brown to dark brown	Yellowish brown to strong brown.	Friable	2–10	Colluvium or local alluvium mainly from granite, gneiss and schist; chiefly from Porters and Ashe soils on mountain uplands.	Well drained.
Eroded hilly phase	TL	6	3	12–25	Brown to yellowish-brown	do	do	2–10	do	Do.
Tusquitee stony loam: Eroded rolling phase	TO	4	3	5–12	Brown	do	do	2–10	do	Do.
Eroded hilly phase	TN	9	4	12–25	do	do	do	2–10	do	Do.
Tyler silt loam	TP	11	4	0–2	Gray	Pale yellow, mottled with gray.	do	5–10	Alluvium mainly from quartzite, shale, siltstone, conglomerate, and sandstone; some dolomite.	Poorly drained.
Whitwell silt loam	WA	2	2	2–5	Brown	Brownish yellow, mottled with yellow, gray, and brown.	do	5–10	do	Imperfectly drained.

[1] See pages 83 to 115 for a discussion of the use and management of these groups.
[2] See pages 116 to 119 for a discussion of these classes.
[3] This is the depth to bedrock or to distinctly different material, as a bed of gravel.
[4] The red shale gives rise to the Teas soil; the green shale, to the Litz soil in this complex.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
JOHNSON COUNTY—TENNESSEE
BALDWIN GAP QUADRANGLE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY



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W. S. Ligon, Principal Soil Correlator, Southern States.
Correlation and inspection by J. W. Moon, Principal Soil Scientist.
Soils surveyed 1942-45 by Ralph G. Leighty, U. S. Department of Agriculture, in Charge, F. R. Austin and Clifton Jenkins, Tennessee Agricultural Experiment Station.

Scale 1:24,000

1 ½ 0 1 2 Miles

5 000 0 5 000 10 000 Feet

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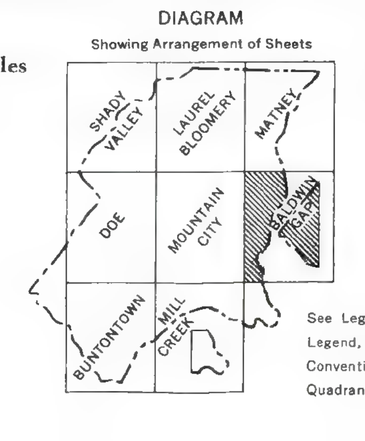
DIAGRAM
Showing Arrangement of Sheets



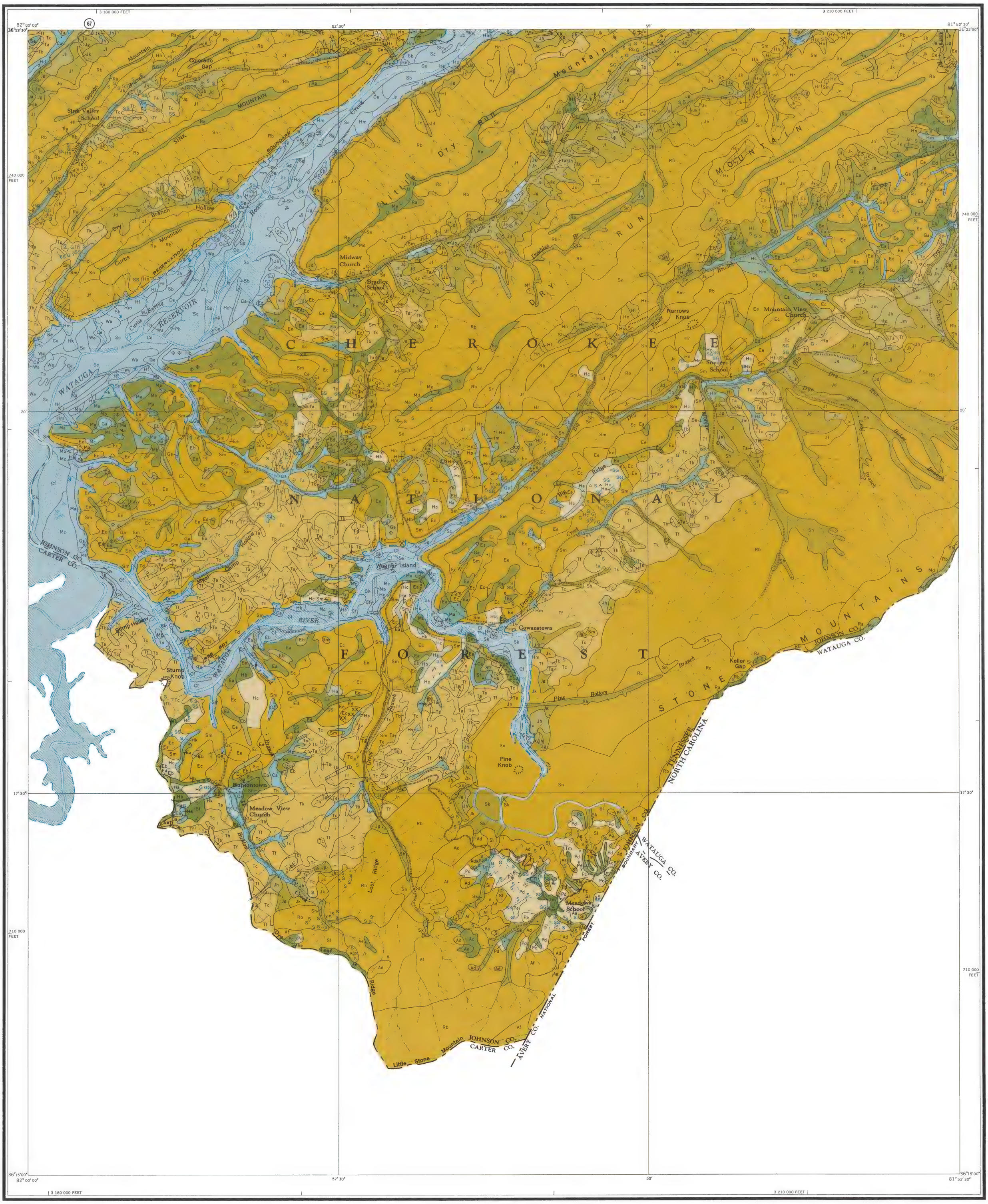
Map compiled and drafted for the Cartographic Division, Soil Conservation Service, by the Maps and Surveys Branch, Tennessee Valley Authority, from TVA topographic quadrangles.
Polyconic projection, 1927 North American datum.
10 000 foot grid based on Tennessee rectangular coordinate system.

See Legend Sheet for Alphabetical Legend, Color Grouping, and Conventional Signs. See Shady Valley Quadrangle for Soil Associations Map.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
JOHNSON COUNTY–TENNESSEE
BUNTONTOWN QUADRANGLE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY



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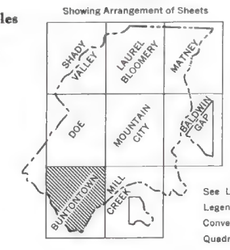

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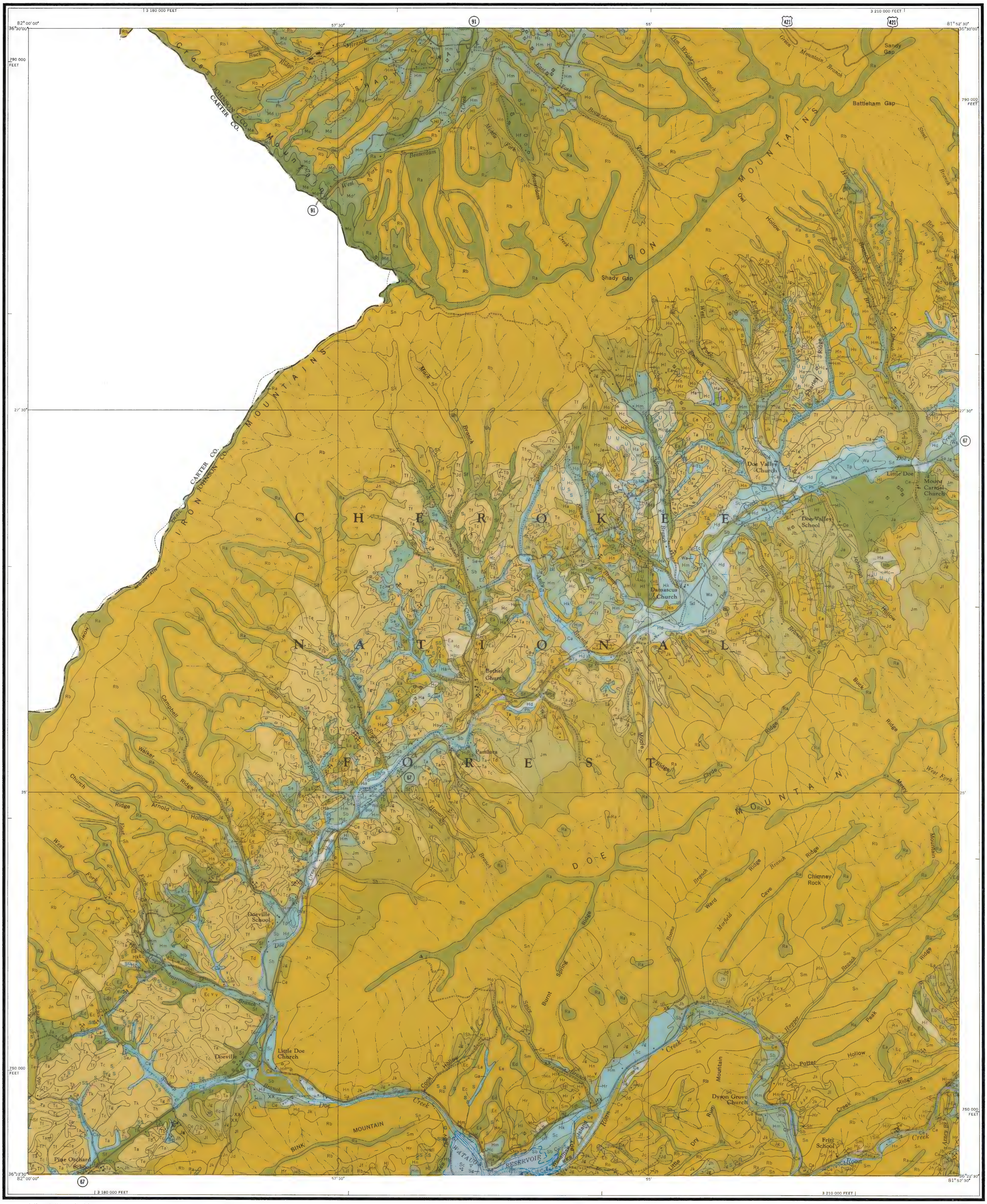
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP

JOHNSON COUNTY–TENNESSEE

DOE QUADRANGLE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY



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1 0 1 2 Miles

5 000 0 5 000 10 000 Feet

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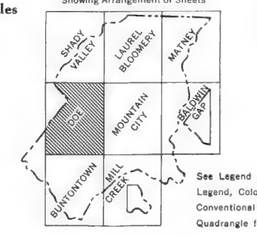

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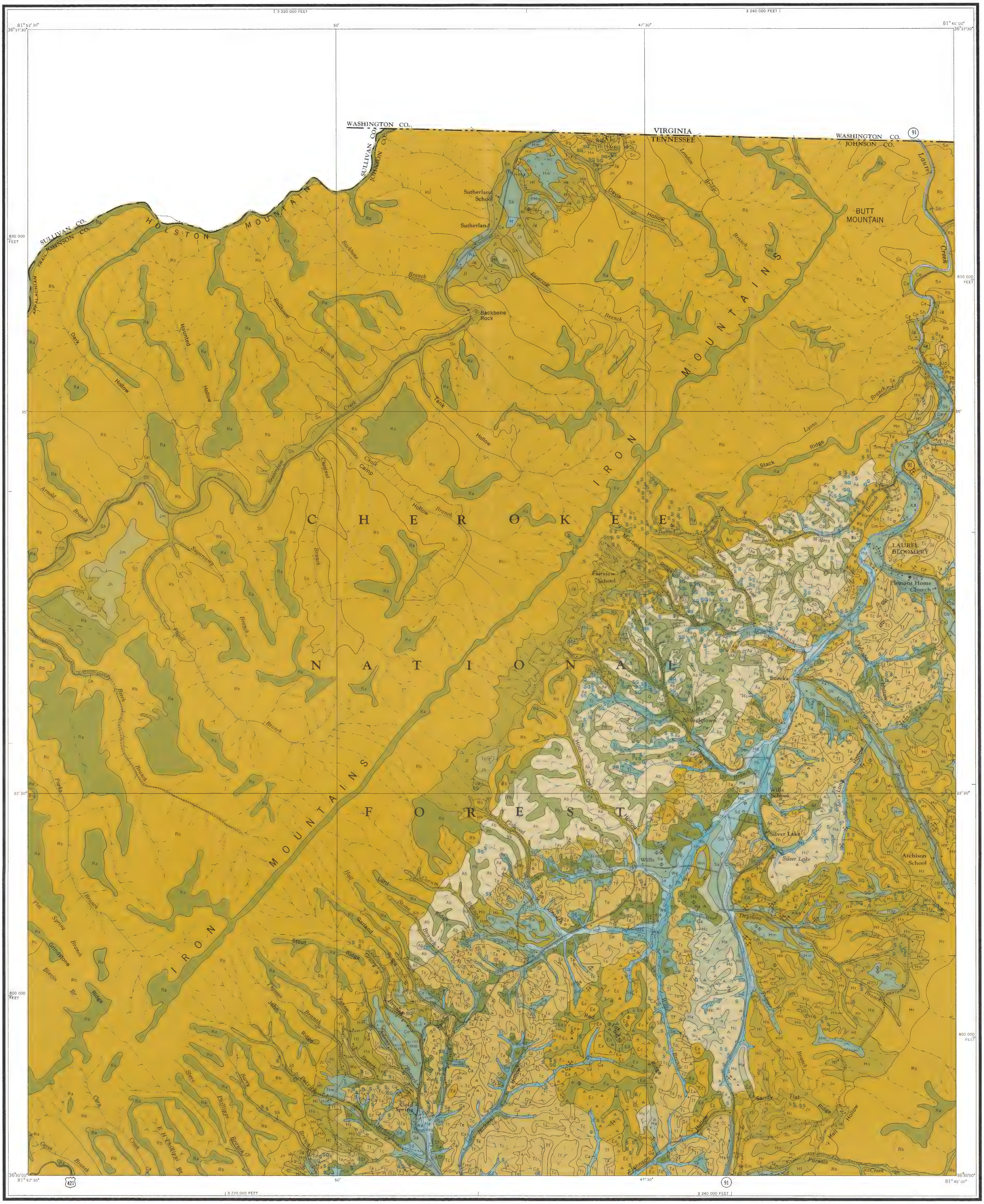
SOIL MAP

JOHNSON COUNTY–TENNESSEE

LAUREL BLOOMERY QUADRANGLE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY



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1 ½ 0 1 2 Miles

5 000 0 5 000 10 000 Feet

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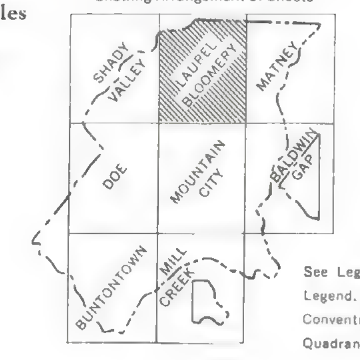

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10 000 foot grid based on Tennessee rectangular coordinate system.

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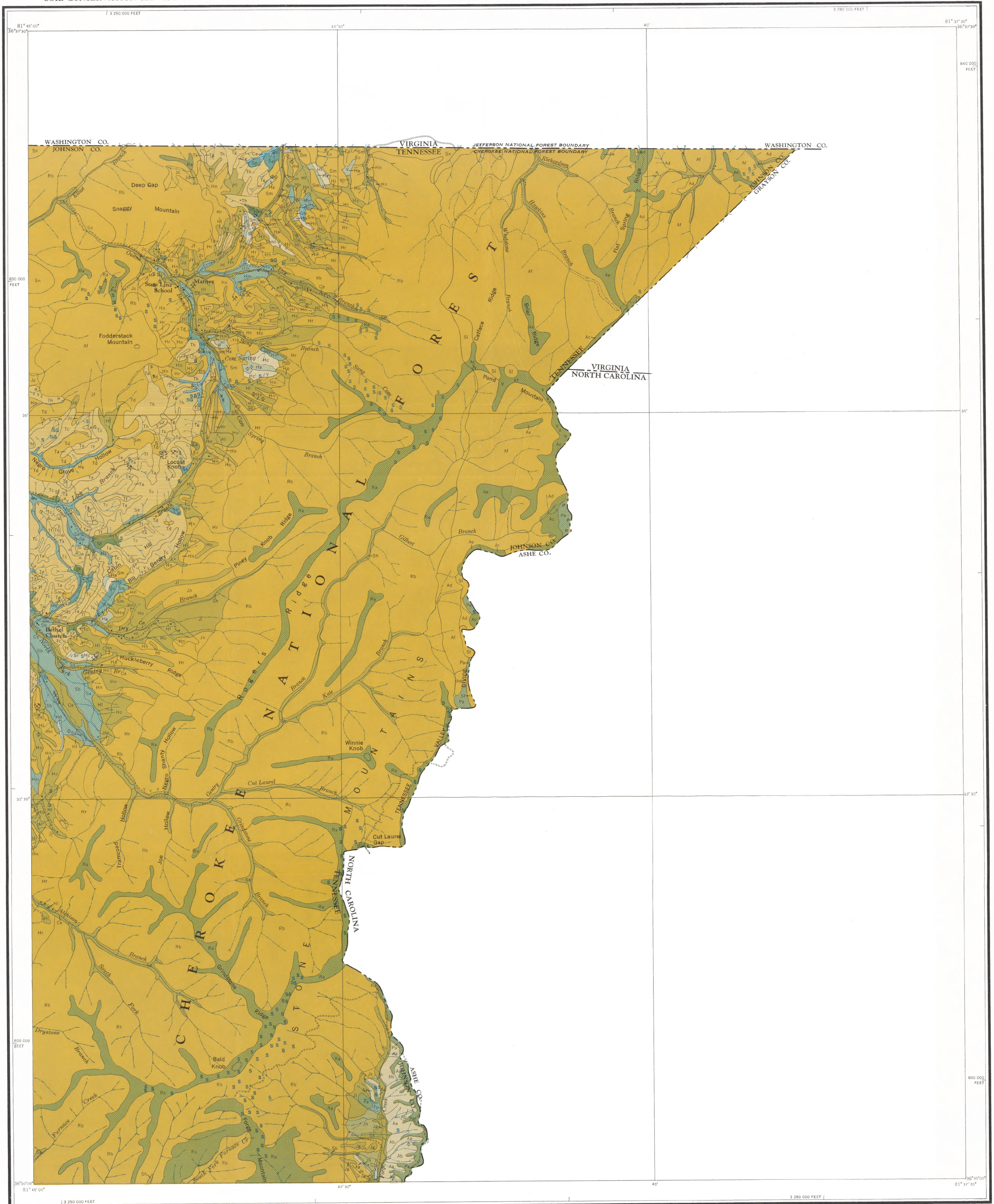
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
JOHNSON COUNTY–TENNESSEE
MATNEY QUADRANGLE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY



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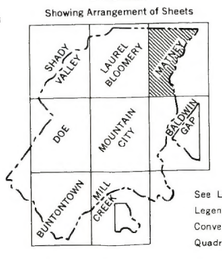

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
JOHNSON COUNTY–TENNESSEE
MILL CREEK QUADRANGLE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

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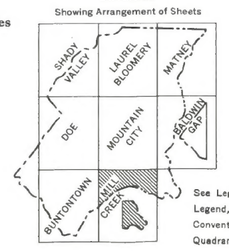
Scale 1:24,000

1 0 1 2 Miles
5 000 0 5 000 10 000 Feet

DIAGRAM
Showing Arrangement of Sheets



See Legend Sheet for Alphabetical Legend, Color Grouping, and Conventional Signs. See Shady Valley Quadrangle for Soil Associations Map.

Map compiled and drafted for the Cartographic Division, Soil Conservation Service, by the Maps and Surveys Branch, Tennessee Valley Authority, from TVA topographic quadrangles. Polyconic projection, 1927 North American datum. 10 000 foot grid based on Tennessee rectangular coordinate system.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1954 J. 29299

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
JOHNSON COUNTY–TENNESSEE
MOUNTAIN CITY QUADRANGLE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

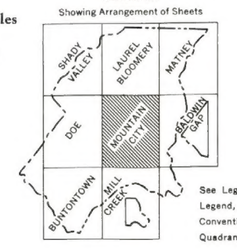
J. Kenneth Ableiter, Chief Soil Correlator.
W. H. Allaway, Chief Analyst Soil Uses and Productivity.
W. S. Ligon, Principal Soil Correlator, Southern States.
Correlation and inspection by J. W. Moon, Principal Soil Scientist.
Soils surveyed 1942-45 by Ralph G. Leighty, U. S. Department of Agriculture, in Charge, F. R. Austin and Clifton Jenkins, Tennessee Agricultural Experiment Station.

Scale 1:24,000

1 0 1 2 Miles

5 000 0 5 000 10 000 Feet

DIAGRAM
Showing Arrangement of Sheets



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☆ U.S. GOVERNMENT PRINTING OFFICE: 1954 J. 292992

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
JOHNSON COUNTY–TENNESSEE
SHADY VALLEY QUADRANGLE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY

3 180 000 FEET — 3 210 000 FEET

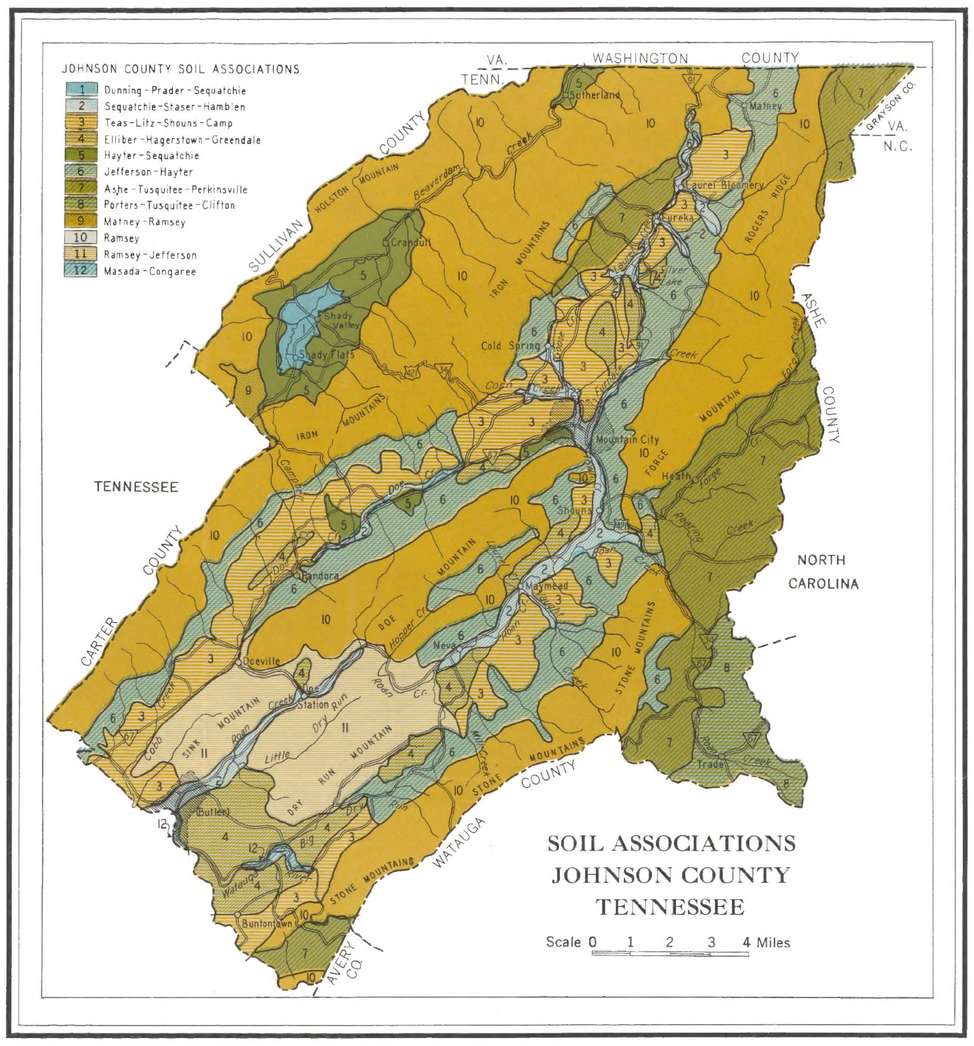
82° 00′ 00″ — 57′ 30″ — 55′ — 81° 52′ 30″

36° 37′ 30″ — 830 000 FEET

35′

32′ 30″ — 600 000 FEET — 800 000 FEET

36° 30′ 00″



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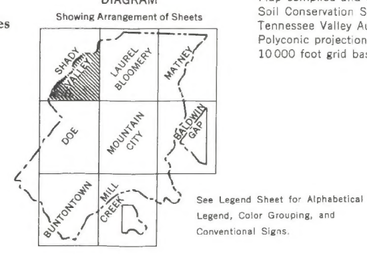
Scale 1:24,000

1 0 1 2 Miles

5 000 0 5 000 10 000 Feet

DIAGRAM
Showing Arrangement of Sheets



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